KNOWLEDGE, PERCEPTION AND INTAKE OF MICRONUTRIENTS (IRON AND FOLIC ACID) AMONG FEMALE CIVIL SERVANTS OF REPRODUCTIVE AGE AT THE OYO STATE SECRETARIAT, IBADAN, NIGERIA

BY

OLANIYI, OLUWADAMILOLA AANU

B.Sc. (Ed) Biology (ILORIN)

MATRIC. NO.: 203067

A Project in the Department of Health Promotion and Education Submitted to the Faculty of Public Health

In partial fulfilment of the requirements for the degree of

MASTER OF PUBLIC HEALTH

(HEALTH PROMOTION AND EDUCATION)

of the

UNIVERSITY OF IBADAN

MAY, 2019

ABSTRACT

The health risk Micronutrient Deficiencies (MNDs) pose to women necessitates continuous monitoring of their dietary intake. MND is a major impediment to socio-economic development contributing to a vicious circle of underdevelopment. It has long ranging effects on health, learning ability and productivity. More than 2 billion people in the world today suffer from MND, where iron deficiency is the most prevalent. The public health importance of these deficiencies lies upon their magnitude and health consequence, so from a public health viewpoint, MND is a concern not just because of the large number of people affected but also because MND, being a risk factor for many diseases can contribute to high rates of morbidity and even mortality. Previous studies conducted on intake of micronutrients among women have focused mainly on pregnant women, thus, there are only few documented studies on knowledge and intake of MNs among WRA. This study was designed to investigate the knowledge, perception and intake of micronutrients (Iron and Folic Acid) among WRA at Oyo State secretariat, Ibadan.

This study was a descriptive cross-sectional survey which employed the use of a multi-stage sampling technique involving four (4) stages to randomly select three hundred and thirty-seven Female Civil Servants. Data were collected using validated semi- structured, self-administered questionnaire. The instrument elicited information on respondents' socio demographic characteristics, knowledge and perception of MNs, dietary and supplement intake of MNs and also sources of information on MNs. Knowledge of micronutrients was measured on a 30-point scale; scores: 0– 15, >15–25 and >25 were categorised as poor, fair an d good, respectively. An 18-point scale was used for scoring perception where scores ≤ 12 entailed negative perception while scores >12 represented positive perception Data were analysed using descriptive and inferential statistics and $p< 0.05$ was set as the level of significance.

Age of the respondents was 35.6 ± 6.9 years, 71.8% were married and majority of the respondents (74.5%) had tertiary education. The overall knowledge of respondents on micronutrient was found at 23.93% (6.9 ± 5.2), almost all of the respondents (97.9%) had poor knowledge while the remaining 2.1% had fair knowledge and none had good knowledge. Most (82.8%) of respondents had a positive perception of micronutrients. Findings revealed that food rich in haem iron, non- haem iron and folic acid were consumed regularly (four or more times in

a week) by 31.7%, 19.5% and 50.8% of the respondents, respectively but most respondents (70.3%) regularly took multivitamin supplements. The test for association revealed that there was no significant relationship between respondents' level of education and knowledge of MNs while there was significant relationship between respondents' knowledge and intake of MNs

It was evident that there was poor knowledge of micronutrient among the respondents coupled with an inadequate intake of dietary micronutrients. Therefore, there is an urgent need for detailed educational intervention aimed at non-pregnant women to tackle this hidden hunger

Keywords: Micronutrient Deficiencies, Female Civil Servants, Consumption of micronutrients.

Word count: **488**

DEDICATION

This project work is dedicated to the Almighty God who is my strength, my fortress, my deliverer and hope.

ACKNOWLEDGEMENTS

My upmost gratitude goes to the Alpha and Omega who is the beginning and the end for helping through my MPH program

My earnest gratitude goes to my wonderful supervisor, Dr, Oyediran Oyewole. I so much appreciate you for your intellectual contributions, patience, support, advice and encouragement in making this work a success. Thank you for making yourself easily accessible despite your demanding official duty.

I appreciate all the lecturers in the department; Prof. O. Oladepo, Prof. A.J. Ajuwon, Prof. O.S. Arulogun, Dr. F.O. Oshiname, Dr. M.A. Titiloye, Dr. Y. John-Akinola, Dr. O.I Dipeolu, Dr. M.M. Oluwasanu and Mrs A.T Desmenu. I am grateful for the knowledge you have transferred to me. Special thanks to Mr John Imaledo, Mr Segun Bello, Miss Olaniyi and Mr Lanre Quadri, thanks for your significant suggestions and assistance rendered.

My immense love and appreciation goes to my sweet and amazing parents Rot. and Mrs Abraham Olaniyi and my great siblings Mrs Olaoseegba, Mrs Akin-Adewale, Dr. Oluwabukunmi and RN. Oluwamayowa for their constant prayers, financial and emotional support, advice and encouragement which contributed greatly to the success of this work.

My heartfelt appreciation goes to my ever supportive awesome husband, Alawode Ayobami Olamilekan. Thank you for loving me and for been there at all times, always making yourself available as a friend, a brother, a father and a husband. I so much appreciate your support.

To my wonderful son that I welcomed during the programme, Alexander Ayomiposi Oluwabamise, I love you so much; you are a blessing to me.

Special thanks to all the respondents that chose to take part in this study survey, your cooperation made this study a success. I also appreciate all my friends and colleagues who have shared brilliant ideas with me.

To everyone that contributed gracefully to the success of this work, I say thank you all.

CERTIFICATION

I certify that this study was carried out by OLANIYI OLUWADAMILOLA AANU under my supervision in the Department of Health Promotion and Education, Faculty of Public Health, College of Medicine, University of Ibadan, Ibadan, Nigeria.

SUPERVISOR

Dr. Oyewole Oyediran Emmanuel

B.Sc., M.Sc., MPH, Ph.D (Ibadan)

Senior Lecturer

Department of Health Promotion and Education,

Faculty of Public Health, College of Medicine,

University of Ibadan, Ibadan, Nigeria.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

APPENDICES

LIST OF ABBREVIATIONS

DFE	Dietary Folate Equivalents
FAO	Food and Agriculture Organization
FCS	Female Civil Servants
IDA	Iron Deficiency Anaemia
MDAs	Ministries, Department and Agencies
MNs	Micronutrients
MNDs	Micronutrient Deficiencies
NPC	National Population Commission
NTDs	Neural Tube Defeats
OSS	Oyo State Secretariat
PRECEDE	Predisposing, Reinforcing, Enabling Constructs in Educational/ Environmental Diagnosis and Evaluation
RDA	Recommended Daily Allowance
RDI	Recommended Dietary Intake
SDGs	Sustainable Development Goals
SPSS	Statistical Package for Social Sciences
US FDA	United State Food and Drug Administration
WHO	World Health Organization
WRA	Women of Reproductive Age

OPERATIONAL DEFINITION OF TERMS

Dietary supplement: A product (other than tobacco) that is intended to supplement the diet, contains one or more dietary ingredients (including vitamins; minerals; herbs or other botanicals; amino acid and other substances) or their constituents which is intended to be taken by mouth as a pill, capsule, tablet, or liquid and is labelled on the front panel as dietary supplement (US Food and Drug Administration, 2011)

Micronutrients: Iron and Folic Acid

Knowledge: This is a familiarity, awareness, or understanding of someone or something, such as facts, information, descriptions, or skills, which is acquired through experience or education by perceiving, discovering, or learning.

Perception: This is the organisation, identification, and interpretation of sensory information in order to represent and understand the presented information, or the environment.

Women of Reproductive Age: These are the women within the age range of 15 – 49 years.

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

Dietary patterns and nutrients intake have been recognized as important factors in health and disease as they are essential constituent in the prevention of diseases and maintenance of health (Block, Jensen and Norkus, 2007). Nutrients of public health concern are those that evidence suggests that their insufficient or excess consumption will manifest or could manifest in a rise of morbidity or mortality, hence, there is a Recommended Nutrient Intake (RNI) to guide human consumption of these nutrients. Requirements for most nutrients are higher for pregnant and lactating women than for adult men (National Research Council, 2006; World Health Organization [WHO]/Food and Agriculture Organization of the United Nations [FAO], 2004). Macronutrients (protein-energy nutrients) refer to the nutrients required in large quantities, such are; carbohydrates, fats and protein. They are essential for the body to grow, repair and develop new tissues, conduct nerve impulses and regulate life processes. Micronutrients (MNs) are dietary components often referred to as vitamins and minerals. Unlike macronutrients, micronutrients are required in very minute amount but they are very vital for the normal functioning of the body. They mainly function to enable chemical reactions to occur in the body, ensure normal metabolism, proper growth and development, adequate cell functioning and work together with enzymes to facilitate a healthy life. Micronutrients are essential elements of good nutrition, and their deficiency in the human diet is responsible for many health problems. Though required in minute quantity, Micronutrients Deficiencies (MNDs) are associated with increased risk of adverse consequences such as poor mental growth, disability and death, thus, an adequate intake is necessary. This deficiency, also known as “hidden hunger” occurs when essential vitamins and/or minerals are not present in adequate amounts in the diet and is becoming more widespread especially in countries in the developing part of the globe. Nutritional deficiencies have become more prevalent following economic stress and food insecurities faced by populations in these developing countries, Nigeria being one of them. Most at risk groups includes children less than 5 years of age, adolescents, women of childbearing age, particularly the pregnant and lactating, refugees and victims of famine (Thompson and Amoroso, 2011).

Adequate nutrition is the fundamental cornerstone of any individual and is very critical for women because inadequate nutrition wreaks havoc not only on her health but also on the health of her children. Children of malnourished women are more likely to encounter cognitive impairments, lower resistance to infections, short stature and a higher risk of diseases throughout their life span. Women of Reproductive Age (WRA) are often nutritionally vulnerable because of their physiological demands. Micronutrients have substantial impact on women's health during adolescence, pre-conception, pregnancy, lactation and the aging years. (Kellee, 2005).

According to the World Health Organisation, Micronutrients such as iron, iodine, zinc, folic acid, and vitamin A are among the most critical MNs for maternal and child health. Among all the hazardous effect of MNDs, iron deficiency is the most common and widespread nutritional disorder in the world, and is a public health problem in industrialised and non-industrialised countries. Iron deficiency is the result of a long-term negative iron balance and in its more severe stages, it causes anaemia, an abnormally low haemoglobin level due to pathological condition(s). Iron is an important component of various enzyme systems, such as the cytochromes which are involved in oxidative metabolism. It is stored in the liver as ferritin and as haemosiderin. The foremost nutrients responsible in the production of haemoglobin are iron, folic acid, and vitamin B12. Folic acid is a B vitamin that is essential for cell growth and reproduction. It helps in preventing diet related chronic disorders like diabetes, hypertension and cancer etc. (Bansal and Mehra 1999)

The prevalence of anaemia (18–51%) among women is a moderate to severe public health problem as per the WHO criteria. Stevens et al. estimated (using data from 1995–2011) that Central and West Africa had the highest anaemia prevalence at about 50% in WRA. This is also in line with a Systematic Review of Data from 2005 to 2015 on Micronutrient Status and Dietary Intake of Iron, Vitamin A, Iodine, Folate and Zinc in Women of Reproductive Age and Pregnant Women in Ethiopia, Kenya, Nigeria and South Africa (Rajwinder, Mieke, Folake, Judith and Afework, 2017). This study was therefore designed to assess the knowledge, perception, dietary intake and dietary supplement intake of micronutrients (Iron and Folic acid) among women of reproductive age.

1.2 Statement of Problem

The importance of female nutrition precedes and extends beyond the reproductive years as it optimizes completion of adolescent growth, build body nutrient reserves before pregnancy

and maintain adequate nutritional status, particularly skeletal health, through the postmenopausal years (Kellee, 2005). Therefore, there is a need for a constant, balanced, and adequate supply of all essential nutrients throughout a woman's lifetime to optimize her health which can be achieved through a consistent balanced intake of nutrient-rich food, including fortified foods, and nutrient supplements when necessary, and regular exercise (Kellee, 2005).

The Rome Declaration on Nutrition in 2014 reported that over two billion people in the world experience deficiencies of micronutrients, in particular vitamin A, iodine, iron, and zinc. Among these micronutrients, iron, folic acid, vitamin D, and zinc are of greatest concern for women of reproductive age due to high losses and requirements. Yet, deficiencies of these essential nutrients are the most common among these women (Nguyen, Le Mai, Nguyen, Bern and Martorell, 2006). In several developing countries, societal norms and gender-based discrimination require women to put their family members before their own health and nutritional needs. Lack of adequate information about the composition of varied feed resources in some regions might be the major drawback to their utilization, rather than real shortage (Aletor and Omodara, 1994). These factors could enhance the deficiency.

In Nigeria, there is very limited information on the mineral elements in some plants used as human food and animal feeds, mostly the newly- introduced varieties of diets and the lesser known legumes (Soetan, Olaiya and Oyewole, 2010). Thus, women are vulnerable to micronutrient deficiencies due to inadequate dietary intake, lack of availability or accessibility of food rich in MNs, inequitable distribution of food within the same household and lack of knowledge about the importance of dietary diversity. These vulnerabilities and gap in diet quality have been recognized for a long time. However, despite decades of appeals to improve women's diet quality and nutrition, there has been little programmatic action towards it. Historically, a major impediment has been lack of effective platforms and programmes reaching adolescent girls and women of reproductive age outside the prenatal care. Hence, Women of reproductive age in low and middle-income countries frequently enter pregnancy malnourished, and the additional needs of pregnancy might further exacerbate micronutrient deficiencies while pregnant (Rajwinder et al. 2017). This has necessitated the need to improve the knowledge of micronutrients among these women in order to improve their health and nutritional status.

1.3 Justification of the study

Women are vulnerable to different health problems which can jeopardize their physical and mental development and that of their offspring. Women of reproductive age are highly susceptible to iron and folic acid deficiencies. Small iron stores coupled with loss of iron due to menstruation place women of childbearing age at risk while women with high menstrual loss (menorrhagia) frequently encounter iron-deficiency anaemia, yet, only 25 percent of these women usually meet the RDA for iron. The additional requirements during pregnancy make it critical for a woman to ensure sufficient iron stores prior to the pregnancy. Aside anaemia and congenital deformities, folic acid deficiency can also result in other health problems such as: higher risk of developing clinical depression, possible problems with memory and brain functioning, higher risk of potentially developing allergic diseases and higher potential of long-term risk of lower bone density. To combat this hidden hunger, WHO suggests that iron and folic acid supplement consumed once, twice or three times a week on non consecutive days is important for women of reproductive age (WHO, 2008).

Women are mostly responsible for food preparation in a household, therefore her nutritional knowledge is capable of altering the health and nutritional status of the entire family members. Addressing women's micronutrient deficiencies has a range of positive effects as healthy women can fulfil their multiple roles of taking care of families' nutrition, attaining their personal goals, generating income and producing healthy children, and thus, advancing socioeconomic development in the country.

Much of the research performed to date on micronutrients intake has been focused on intake among pregnant women. In view of the heath benefit of adequate intake of micronutrients, the results from this study will contribute to the growing body of knowledge, provide data about the knowledge and perception of micronutrients among women, various dietary and supplement intake of these nutrients and sources of information available to them on micronutrients. The data provided will serve as basis for developing nutritional education programme and interventions that will improve the quality of life, reduce morbidity as well as health care cost. Achievement of Sustainable Development Goal 3 "Good Health and well-Being" will also be enhanced.

1.4 Research Questions

i. What is the level of knowledge of Micronutrients among Female Civil Servants of Reproductive age at the Oyo State Secretariat, Ibadan?
ii. What is the perception of Micronutrients among Female Civil Servants of Reproductive age at the Oyo State Secretariat, Ibadan?
iii. What is the dietary and dietary supplement intake of Micronutrients among Female Civil Servants of Reproductive age at Oyo State Secretariat, Ibadan?
iv. What are the sources of information on Micronutrient intake available to Female Civil Servants of Reproductive age at the Oyo State Secretariat, Ibadan?

1.5 Objectives of the Study

1.5.1 Broad Objective

The main objective of the study was to investigate the knowledge, perception and intake of Micronutrients among Female Civil Servants of Reproductive age at the Oyo State Secretariat, Ibadan.

1.5.2 Specific Objectives

The specific objectives of the study were to:-

1. Assess the knowledge of Micronutrients among Female Civil Servants of Reproductive age at Oyo State Secretariat, Ibadan
2. Determine the perception of Micronutrients among Female Civil Servants of Reproductive age at Oyo State Secretariat, Ibadan
3. Determine the dietary and dietary supplement intake of Micronutrients among Female Civil Servants of Reproductive age at Oyo State Secretariat, Ibadan
4. Identify the sources of information on Micronutrient intake available to Female Civil Servants of Reproductive age at Oyo State Secretariat, Ibadan

1.6 Hypotheses

The study tested the following null hypotheses:

Ho 1: There is no significant association between level of education and knowledge of Micronutrients among Female Civil Servants of Reproductive age

Ho 2: There is no significant association between age and intake of Micronutrients among Female Civil Servants of Reproductive age

Ho 3: There is no significant association between knowledge and intake of Micronutrients among Female Civil Servants of Reproductive age

CHAPTER TWO

REVIEW OF LITERATURE

2.1 Micronutrients

Micronutrients comprise of vitamins and minerals which are required in small quantities to ensure normal metabolism, growth and physical well-being. Vitamins are essential organic nutrients mainly obtained through food. They include vitamin A, provitamin A (Beta carotene), vitamin B1, vitamin B2, vitamin B6, vitamin B12, biotin, vitamin C, vitamin D, vitamin E, folic acid, vitamin K, niacin and pantothenic acid. Minerals are inorganic nutrients found in small quantities within the body and obtained from a wide variety of foods. They include the trace elements copper, iodine, iron, manganese, selenium and zinc together with the macro elements calcium, magnesium, potassium and sodium.

2.2 Micronutrient Deficiency

Deficiency in micronutrients known as hidden hunger is a public health issue affecting all age groups especially young children and women in the industrialized nations and developing regions of the world (WHO, 2006). Micronutrient deficiencies affect at least 2 billion people worldwide (FAO, 2015). It causes untold human suffering and levies huge costs on society in terms of unrealized human potential and lost economic productivity. Micronutrient deficiencies are common in many developing countries and are typically due to inadequate food intake, poor dietary quality, poor bioavailability (because of the presence of inhibitors, mode of preparation, and interactions), and/or the presence of infections (Ramakrishnan, 2002). Iron, iodine, folate, vitamin A, and zinc deficiencies are the most widespread micronutrient deficiencies, and are common contributors to poor growth, intellectual impairments, perinatal complications, and increased risk of morbidity and mortality (Bailey, West and Black, 2015).This research focused on a vitamin (Folic acid) and a mineral (Iron) of importance within the study population.

2.3 Folic Acid

According to the British Dietetic Association (BDA), folic acid is a B vitamin which is vital for the formation of red blood cells as well as the synthesis and repair of DNA and RNA, aiding rapid cell division and growth, enhancing brain health and age-related hearing loss. It occurs naturally in foods such as leafy vegetables (e.g. spinach, broccoli, and lettuce), okra,

asparagus, fruits (e.g. bananas, melons, and lemons) beans, yeast, mushrooms, meat (e.g. beef liver and kidney), orange juice, and tomato juice as folate.

2.3.1 Health claims of Folic Acid

Folic acid is often used in combination with other vitamins for prevention of miscarriage, neural tube defects and other congenital anomalies in women who are pregnant or of reproductive ages (Lumley, Watson, Watson and Bower, 2001; Wilson. 2015; Gool, Hirche, Lax and Schaepdrijver. 2018). A deficiency of folate increases the risk of neural tube defects, as well as contributing to hyperhomocystinemia, a condition associated with increased cardiovascular disease and neural tube defects (Berg, 1999).

Folic acid is used in conditions commonly associated with folate deficiency, including ulcerative colitis, liver disease, alcoholism, and kidney dialysis (Cravo and Camalo, 2000; Ho, Boyapati and Satsangi, 2015; Wyatt and Spence, 2016; Tiwari, Mahdi and Mishra, 2018). For the prevention of neural tube defects, it is recommended that a woman of childbearing age consume a daily folate intake of 400 micrograms; however, the average dietary folate intake is half that amount, and the FDA folate fortification of cereal grains adds only 100 micrograms daily (Berg, 1999).

Folic acid is also used in the prevention of colon cancer, cervical cancer or breast cancer (Fuchs, Willett, Colditz, Hunter, Stampfer, Speizer and Giovannucci . 2002; Garcia-Closas, Castellsague, Bosch and Gonzalez, 2005; Roswall, Olsen, Christensen, Dragsted, Overvad and Tionneland, 2010; Kayani, Bordbar and Firuzi, 2018),prevention of cardiovascular diseases such as stroke (Zhou, Zhu, Wu and Fang, 2013; Goel and Messerli, 2015), prevention of cognitive impairments (Deniz, Confortim, Deckmaann, Miguel, Bronauth and Oliverira et al., 2018) and reduction of serum homocystrine in post-menopausal women (Scorsatto, Uehara, Luiz, Oliveira and Rosa, 2011; El-Kadi and Frag, 2014). In addition, it is used for memory loss, Alzheimer's disease, age-related hearing loss, preventing the eye disease age-related macular degeneration (AMD), reducing signs of aging, weak bones (osteoporosis), jumpy legs (restless leg syndrome), sleep problems, depression, nerve pain, muscle pain, AIDS, a skin disease called vitiligo, and an inherited disease called Fragile-X syndrome.

2.3.2 Folic Acid Deficiency

The primary clinical sign of foliate deficiency is megaloblastic anemia which is characterized by large, abnormally nucleated erythrocytes (Carmel, 2005; Bailey and Caudil, 2012). Its symptoms include weakness, fatigue, difficulty concentrating, irritability, headache, heart palpitations, and shortness of breath (Institute of Medicine, 1998). Folate deficiency can also produce soreness in and shallow ulcerations on the tongue and oral mucosa; changes in skin, hair, or fingernail pigmentation; gastrointestinal symptoms; and elevated blood concentrations of homocysteine (Ho, Cheung, Fu, Win, Zaw and Ng et al., 2011; Bailey et al., 2012).

Women with insufficient folate intakes are at increased risk of giving birth to infants with NTDs (Institute of Medicine, 1998). Inadequate maternal folate status has also been associated with low infant birth weight, preterm delivery, and fetal growth retardation (Scholl and Johnson, 2000; Bailey et al., 2012).

2.3.3 Prevalence of Folic Acid Deficiency

Many countries have successfully reduced the prevalence of folate deficiency through mandatory folic acid fortification programs, based on the limited data available, folate deficiency still appears be a public health problem in some settings, particularly for women (McLean, Benoist, and Allen, 2008; Bailey, Stover, McNulty, Fenech, Gregory,Mills and Pfeiffer et al. 2015).

A systematic review conducted for Ethiopia, Kenya, Nigeria and South Africa found 46% prevalence of folate deficiencies among Women of Reproductive Ages and a range of 3-12% prevalence of folate deficiencies among pregnant women in these countries (Harika, Faber, Samuel, Kimiywe, Mulugeta and Eilander, 2017).A study of Ethiopian women showed 31.3% prevalence of deficiency of folic acid among women with a 40% likelihood of folic acid deficiency in the population (Haidar, 2010).

Of a total of 5658 serum samples processed to determine folic acid and vitamin B12 concentrations, the prevalence of folic acid deficiency and vitamin B1 deficiency among adolescents and pregnant women in Venezuela was higher than 30% reaching 81.79% and 11.4% respectively in adolescents. Similarly, pregnant women had a prevalence of 36.32 and 61.34 folic acid and vitamin B12 deficiencies respectively (Garcia-Casal, Osorio, Landaeta, Leets, Matus and Fazzino et al., 2005)

2.3.4 Risk Factors for Folic Acid Deficiency

The most common causes of folate deficiency include an inadequate diet, alcoholism, and difficulties in absorbing nutrients (Carmel, 2005). A low intake of foods containing folate combined with a relatively high intake of refined cereals thus increases the risk for folate deficiency. Malabsorption conditions, infection with Giardia lamblia, bacterial overgrowth, genetic disorders (of folic acid metabolism) and chronic alcoholism are also risk factors for folate deficiency. In addition, the body requires the conversion of folic acid to its active form, methylfolate. Genetics can occasionally get in the way of this conversation, which can lead to a folate deficiency.

2.3.5 Recommended intake of Folic Acid

According to the Institute of medicine (1998), the recommended daily allowance of folate for women categorized by age is stated in table 2.3.

Folic acid is available in multivitamins and prenatal vitamins, supplements containing other B-complex vitamins, and supplements containing only folic acid. Common doses range from 400 to 800 mcg in supplements for adults and 200 to 400 mcg in children's multivitamins (Yeubg, Cogswell, Carriquiry, Bailey, Pfeiffer and Berry, 2011; NIH, 2018). About 85% of supplemental folic acid, when taken with food, is bioavailable (Carmel, 2005). When consumed without food, nearly 100% of supplemental folic acid is bioavailable.

Table 2.3: **Recommended intake of folate for women**

Age	Female	Pregnancy	Lactation
Birth to 6 months*	65 mcg DFE*		
7-12 months*	80 mcg DFE*		
1-3 years	150 mcg DFE		
4-8 years	200 mcg DFE		
9-13 years	3000 mcg DFE		
14-18 years	400 mcg DFE	600 mcg DFE	500 mcg DFE
19+ years	400 mcg DFE	600 mcg DFE	500 mcg DFE

*Adequate intake
DFE- Dietary Folate Equivalents

(*Source: Institute of Medicine, 2001*)

2.4 Iron

Food and nutrition board defined iron as a mineral that is an important component of haemoglobin, myoglobin, enzymes, and cytochromes and is necessary for oxygen transportation and cellular respiration which entails release of energy. According to the Academy of Nutrition and Dietetics, iron is a mineral, and its main purpose is to carry oxygen in the hemoglobin of red blood cells throughout the body so cells can produce energy. Most of the iron in the human body is present in the erythrocytes as haemoglobin, where its main function is to carry oxygen from the lungs to the tissues. Iron is also an important component of various enzyme systems, such as the cytochromes, which are involved in oxidative metabolism. It is stored in the liver as ferritin and as haemosiderin. Iron is richly available in animal sources such as meat, seafood and poultry which represents the haem iron and in plant sources such as beans and lentils, tofu, baked potatoes, cashews, dark green leafy vegetables such as spinach, fortified breakfast cereals, whole-grain and enriched breads (the non-haem iron).

2.4.1 Health claims of Iron

Iron performs many important functions in the body. It is primarily involved in the transfer of oxygen from the lungs to tissue. However, iron plays a role in metabolism as a component of some proteins and enzymes. It is found in two forms, essential iron for normal function of the body and the reserve for times of needs. The essential iron is mostly haemoproteins and is present in haemoglobin or erythron and is the major part of the body iron.

2.4.2 Iron Deficiency

Inadequate concentration of iron in the body results in iron deficiency which is the most common and widespread nutritional disorder in the world affecting both industrialized and non-industrialized countries. Iron deficiency is the result of a long-term negative iron balance; in its more severe stages, iron deficiency causes anaemia- low blood haemoglobin concentration.

Isolated iron deficiency is uncommon as people with iron deficiency usually have other nutrient deficiency. The World Health Organization (WHO) in 2008 estimated that approximately half of the 1.62 billion cases of anaemia worldwide are due to iron deficiency. In developing countries, iron deficiency often results from enteropathies and blood loss associated with gastrointestinal parasites.

2.4.3 Prevalence of Iron Deficiency

Studies of prevalence in iron deficiency separate iron depletion (defined as decreased blood ferritin) and iron deficiency anaemia (defined as blood decrease in both ferritin and hemoglobin).Globally, iron deficiency ranks number 9 among 26 risk factors included in the GBD 2000, and accounts for 841,000 deaths and 35,057,000 disability-adjusted life years lost. Africa and parts of Asia bear 71% of the global mortality burden and 65% of the disability-adjusted life years lost, whereas North America bears 1.4% of the global burden (Stoltzfus, 2003).In Europe, prevalence of iron depletion varies from 7 to 18 % and 24 to 36% in toddlers and adolescents, respectively while iron depletion anaemia ranged between 7.2 and 13.96 per 1000 person years with higher estimates in Spain and Germany (Levi, Rosselli, Simontti, Bringnoli, Cancian and Masotti et al., 2016). Females, younger and older patients were at greater risk of IDA, as well as those suffering from gastrointestinal diseases, pregnant women and those with history of menometrorrhagia, and aspirin and/or antacids users. Prevalence of iron deficiency anaemia varies from 2 to 8.5% and 7 to 10% in toddlers and adolescents in French speaking African countries (Dupont, 2017).

A study that estimated the prevalence of iron deficiency with or without concurrent anaemia in different population groups from Côte d'Ivoire found the prevalence of iron deficiency was 41–63% in the women and children whereas the prevalence of iron deficiency anaemia was 20–39% in the women and children (Asobayire, Adou, Davidsson, Cook and Hurrell, 2001). In Rwanda, a study found the prevalence of iron deficiency in women to range 3.0% to 4.8% while the prevalence of iron deficiency anaemia ranged from 1.4% to 5.6% (Danahue, Berti, Seikmans, Tugirimana and Boy, 2017).

In Nigeria, the prevalence of iron deficiency anaemia were found to be significantly higher ($p<0.05$) among pregnant women(15.7%) when compared to non-pregnant women. It was also shown that pregnant women in their third trimesters and multigravidae had the highest prevalence of iron deficiency and iron deficiency anaemia (Okafor, Enosakhare, Antai and Usanga, 2013). Also, iron deficiency and iron deficiency anaemia were significantly higher among pregnant women from rural communities compared to urban communities in South-South Nigeria (Okafor, Okpokam, Antai and Usanga, 2016).

2.4.4 Risk Factors for Iron Deficiency

Risk factors for iron deficiency include a low intake of haem iron (which is present in meat, poultry and fish); an inadequate intake of vitamin C (ascorbic acid) from fruit and vegetables (the presence of vitamin C enhances the absorption of iron from the diet) when consuming non-haem iron; poor absorption of iron from diets high in phytate (including legumes and cereals) or phenolic compounds (present in coffee, tea, sorghum and millet); periods of life when iron requirements are especially high (i.e. growth and pregnancy); heavy blood losses as a result of menstruation, or parasite infections such as hookworm, ascaris and schistosomiasis; chronic infections such as malaria; and the presence of other micronutrient deficiencies especially vitamins A and B_{12}, folate and riboflavin (Allen and Casterline-Sabel, 2000; Menendez, Fleming and Alonso, 2000; WHO 2001;WHO 2005).

The main consequences of iron deficiency include reduced cognitive performance, lower work performance and endurance, impaired iodine and vitamin A metabolism, anaemia, increased risk of maternal mortality and child mortality(with more severe anaemia)(WHO 2001; Brabin, Hakimi and Pelletier, 2001; Brabin, Premji and Verhoeff, 2001; Brownlie, Utermohlen, Hinton, Giordano and Haas, 2002).

2.4.5 Recommended intake of Iron

According to the Institute of Medicine, (2001), the recommended daily allowance (RDA) of iron is different for women of different ages. See Table 2.4

Iron is also available in many dietary supplements. Multivitamin or multi-mineral supplements with iron, especially those designed for women, typically provide 18 mg iron. Iron-only supplements usually deliver more than the daily value, with many providing 65 mg iron which is 360% of the recommended daily value (National Institute of Health, 2018).

Table 2.4: The recommended daily allowance (RDA) of iron is for women

Age	Female	Pregnancy	Lactation
Birth to 6 months*	0.27mg*		
7-12 months*	11mg		
1-3 years	7 mg		
4-8 years	10 mg		
9-13 years	8 mg		
14-18 years	15 mg	27 mg	10 mg
19 – 50 years	18 mg	27 mg	9 mg
51 + years	8 mg	8 mg	

*Adequate intake

(*Source: Institute of Medicine, 2001*)

2.5 Knowledge of Micronutrients

In a survey conducted by Gallup (2008) to assess the knowledge of women on folic acid supplementation, it was reported that more than 80 percent of women ages 18-45 have heard or read something about folic acid in 2008, yet only 11 percent of women know it should be taken daily before pregnancy to reduce the risk of birth defects.

Another study carried out in Saudi Arabia by Alblowi and Alomayri (2018), on the assessment of knowledge, awareness, and behavior of folic acid use among females during the childbearing period in Tabuk City-2017, it was recorded that there was a significant relation between age and awareness about folic acid, and also for occupation of women and awareness of folic acid. Awareness level for folic acid was high (94%) and the majority of the respondents who had high knowledge and awareness of folic acid were university graduates.

In the United States of America, approximately 77% of all women had heard or read about the benefits of folic acid. Just slightly over one-half of all women reported that they had heard about folic acid from their doctor or health care provider. Only about 26% of women took folic acid every day prior to pregnancy, according to CDC recommendations. Mothers who were older, better educated, married, and had higher incomes were most likely to have heard about folic acid and to have taken it every day before pregnancy (Meyer, Hayes, Morgan, Devine and Powers, 2011).

El-Mani, Charlton, Flood and Mullan (2014) suggested that in Australia, 76% of the participants correctly identified NTDs to be associated with inadequate intake of folic acid, whereas only 40% correctly identified health problems associated with inadequate iodine intake. Women's knowledge of dietary sources of folic acid and iodine was limited. In Puerto Rico however, 77% of the women understood that the best time to start Folic Acid supplementation was prior to conception, most referred to have received information about Folic Acid benefits from a healthcare professional, yet many could not identify all of Folic Acid benefits.(Rivera-Segarra, Ramos-Tollinchi, Cardenas-SuartezandRomaguera, 2016).

Van Ejisden, Van der Wal and Bonsel (2006) revealed that periconceptional folic acid knowledge was significantly lower among Ghanaian, Moroccan, Turkish, and other non-Western women than among women born in the Netherlands or other Western countries. Language proficiency in Dutch was determined as a major determinant of knowledge in all

the ethnic groups with a mother tongue other than Dutch while educational attainment was of secondary importance. Knowledge in turn was the strongest determinant of use.

In a European survey, 70% of women reported that they had heard of folic acid and 40% stated that they knew the benefits of folic acid. However, when prompted to indicate which diseases and/or birth defects folic acid can protect against, only 17% knew that folic acid can reduce the risk of neural tube defects (Bitzer, von Stenglin and Bannemerschult, 2013).

In Malaysia, 88.3% of the respondents reported to have heard of folate, but only 8% were assessed with good knowledge. Majority (49.3%) were informed about folate by physicians or obstetricians. Educational level and household income are significantly predictive of good level of knowledge and practice. Higher educational qualification is also predictive of positive attitude towards folic acid use (Keshavari, Ting, Yi and Yusoff, 2016).

In a multi country study in Qatar and Oman, it was found that 94% of the women knew about folic acid and 41.3% knew it should be taken periconceptionally, 58.5% knew that it prevents birth defects and 34.4% were able to identify five or more food sources of folic acid. Knowledge was significantly influenced by ethnicity, age, education level, employment and family income (Hassan and Al-Kharusi, 2008).

Kohen, Derbent, Erof, Saygirr, Ayik and Karaca (2013) revealed that 48.2% of Turkish women were aware of folic acid for the prevention of congenital anomalies. Knowledge and use of folic acid increase with socio-economic status and educational level. Participants who were already knowledgeable about folic acid cited health care professionals as common sources of information. A study carried out in Libya showed that 73% of the participants had heard about folic acid, and only 37% could correctly identify the effect of folic acid when used periconceptionally (Abdulmalek, 2017).

In a study conducted by Kabir (2010) on dietary pattern, nutritional status and anaemia-related knowledge in urban adolescent college girls of Bangladesh, it was revealed that majority of the participants (73.8%) had no idea about the sources of iron rich foods.

In another study carried out by Theng, Zakaria and Yusof (2017) in Terengganu, it was found that the level of knowledge on consumption of iron supplement was high, 58.3%. The level of knowledge on consumption of iron supplement was highly associated with the consumption of iron supplement. Also in India, a study showed that knowledge about food rich in iron was

poor among the pregnant women. At least 20% of the participants have not received educational information regarding anemia from any source (Nivedita and Fatima, 2016).

2.6 Micronutrients Intake (Dietary and supplement intake)

Findings from a health survey on Dietary intake patterns and nutritional status of Women of Reproductive Age in Nepal showed that the majority of women in all the eco-logical regions consumed meat and fruits once a week (Bhandari, Sayami, Thapa, Kande and Banjara, 2016). In India, the frequency of consumption of meat and fruits was once a week in 31.9% and 33.0% of women (Padmadas, Dias and Willekens, 2006)

Knowledge, attitude and practice of good nutrition among women of childbearing age in Somolu Local Government are of Lagos State was assessed by Fasola, Olayinka and Foluke (2018) revealed that 56.1% and 50.00% of respondents ate fruits and vegetables daily. Studies from mainly low- and middle-income countries showed that 78.4% of women consumed less than the minimum recommended servings of fruits and vegetables (Hall, Moore, Harper and Lynch, 2009)

An Ethiopian study revealed that the adherence rate for iron-folic acid supplementation among pregnant women was found to be 64.7%. Women who were having lower knowledge about anemia and not receiving information about importance of iron-folic acid supplementation were negatively associated with adherence to iron and folic acid. Having four or more antenatal care visits was positively significantly associated with adherence to iron-folic acid supplementation (Getachew, Abay, Zalalem, Gebremedhin, Grum, andBayray, 2018).

Moradi, Mohammadi, Kadivar and Masoumi (2007) carried out a study in Fars province of Iran to assess the intake of iron supplement by pregnant women, it was found that 5.9% of pregnant women were aware about the reason of iron supplementary use during pregnancy, 86.3% knew the method of administration and 91% used supplements containing iron after fourth month of pregnancy.

Taye, Abeje and Mekonen (2015) assessed the factors associated with compliance of prenatal iron folate supplementation among women in Mecha district, Western Amhara of Ethiopia, and it was found that while 20.4% of participants were compliant with iron foliate supplementation, a larger proportion of the respondents' belief that too many tablets would harm the baby and fear of side effects were the major reasons given for noncompliance.

Furthermore, age of the mother, educational status of the mother, knowledge of anaemia and iron folate tablets, and history of anaemia during pregnancy were significantly associated with compliance to iron folate supplementation.

Majority of pregnant women in Terengganu consumed iron supplement during the pregnancy (77.5%). Only 18.3% of pregnant women do not consume iron supplement and another 4.2% not sure whether they consumed iron supplement. The prevalence of anemia in this study was low (19.2%)(Theng, Zakarian and Yusof, 2017).Iron supplement uptake was also assessed in India and it was found that 74.36% claimed to have taken iron supplementation regularly whereas 9.8% had not taken iron supplementation (Nivedita and Fatima, 2016).

Abdulmalek (2017) carried out a study in Libya to assess the practice regarding Folic Acid among women in Benghazi and found that 27% of the pregnant women did not take folic acid during their present pregnancy. Only 6% of the women who took folic acid were taking it consistently before pregnancy with the aim of preventing NTDs. Another study carried out in Australia revealed that 82% of women reported using supplements during their pregnancy, with the majority taking supplement brands containing both folic acid and iodine. Supplement use was significantly higher among women in the highest household income category (Mani, Charlton, Flood and Mullan, 2014).

Rivera-Segarra, Ramos-Tollinchi, Cardenas-Suartez and Romaguera (2016) revealed that while level of knowledge is high among women, only 23% of the participants actually began preconceptional Folic Acid intake. Hassan and Al-Kharusi (2008) revealed that in Qatar and Oman, majority (88.7%) of women were taking the supplement, 85.0% were taking it regularly and 13.2% took it before getting pregnant. Use of this supplement was significantly influenced by ethnicity, age, education level, employment and family income. Periconceptional use of supplement was lowest among younger women (4.9%) and illiterate and least educated women (5.3%).

In Turkey, only 14.2% of them stated that they had used folic acid in the pre-conception period. The use of folic acid during the first trimester among pregnant women was 48.6%. Furthermore, 18.4% of participants had not used folic acid and 29.3% of them had not remembered whether they had or not. Even though 94.4% of health care professionals had heard about folic acid, 28.3% reported that they had used folic acid before pregnancy (Kohen, Derbent, Erof, Saygirr, Ayik and Karaca, 2013).

In a systematic review and meta-analysis carried out by Peake, Copp and Shawe (2013) to assess the periconceptional use of folic acid, evidence indicates that South Asians specifically have less knowledge and lower periconceptional use of folic acid than Caucasians; one study found that West Indian and African women also had lower folic acid uptake. A synthesis of results from three of the studies, in a meta-analysis, shows that Caucasians are almost three times more likely to take folic acid before conception than non-Caucasians.

The current intake of iron from dietary sources has been found to be below the lower recommended nutrient intake in over 40% of 19-64 year old women (Henderson et al., 2003). It is recommended that women planning pregnancy should ensure they achieve adequate intake of iron.

Adherence to iron supplementation is however, an issue and remains difficult to attain partly due to operational difficulties during programs and those women who do not adhere to iron tablets do not take the recommended dose and this raises the issue of whether they are bothered about their risk of anaemia especially during pregnancy (Tetaley, Dibley, Roberts, Hall and Agho, 2009).

In another study to determine prevalence of anaemia and iron deficiency,90% of the respondents who were pregnant reported taking iron supplementation in their last pregnancies with the majority of them starting it in the first trimester.(Chandyo, Ulak, Thome-Lyman, Shrestha and Locks,2016).

In India, 63.14% of pregnant women consumed the iron supplement tablets. Out of 221 only 123 (55.65%) were consuming it correctly. Reasons for not consuming iron supplement were forgetfulness in 48(37.20%), side effects in 35 (27.13%), frustration with daily dose 23 (17.82%), ignorance 21 (16.27%), foul smell of tablets 20 (15.50%), misbelieves 7 (5.42%) and no response was given in 26 (20.15%)(Sonkar, Khan, Domple and Inamdar, 2017).

2.7 Intervention Strategies

There are several different approaches to combating micronutrient malnutrition at the level of populations and vulnerable groups. Micronutrient deficiencies are mainly prevented through balance diet. Gibson (2004) explained the basic strategies for preventing micronutrient deficiencies in developing countries to include supplementation to those 'at risk', and food-based strategies involving fortification and dietary diversification/modification with minimal risk of antagonistic micronutrient interactions. Of these, multi-micronutrient fortification of

centrally processed staple foods or condiments is now feasible, but inappropriate in subsistence settings. Instead, for the latter, more sustainable approaches involve biofortification of plant-based staples, and promotion of small-livestock production, aquaculture, and consumption of animal source foods. In addition, household dietary strategies involving changes in food preparation and processing can be used to alter the content of micronutrient absorption modifiers in plant-based diets. Practical methods involve consumption of absorption enhancers, and use of germination, fermentation, and soaking to reduce the phytate content of cereal flours by enzyme-induced hydrolysis of phytate and/or passive diffusion of water soluble phytate.

Another approach to preventing micronutrient deficiency which has been integrated to public health programs is education and dietary diversification. The major advantage of this strategy is sustainability when educational interventions are well designed and delivered, the audience is motivated, and provided there are no other serious constraining factors in terms of access to food (Harrison, 2010).

2.8 Conceptual Framework

A conceptual framework is the presentation of the proposed causal linkages of a problem among a set of concepts believed to be related to specific health challenge. It is usually developed with the aim of providing a guide to health education research and practice. It reveals a part of the causal web selected to explain the relationship among variables of interest. The conceptual framework are designed and adopted for use as they allow instant visualisation of relationship. For this study, Conceptual Framework of PRECEDE model was adopted.

2.8.1 Conceptual Framework of PRECEDE for knowledge, perception and intake of micronutrients among women of reproductive age.

The acronym “PRECEDE” stands for Predisposing, Reinforcing, Enabling Constructs in Educational/ Environmental Diagnosis and Evaluation. The model was developed by Green, Kreuter, Partridge and others. It offers a framework for identifying behavioural antecedent factors and appropriate intervention strategies, therefore it is an important conceptual framework in health education planning aimed at diagnosing the health problems of a community, understanding the factors that influence the people’s behaviour and developing appropriate intervention to promote healthy behaviour or alter a behaviour to positive ones

(Green and Kreuter, 1991). The model consists of three main factors that influence human behaviour positively or negatively. They are predisposing, reinforcing and enabling factors. This model was therefore applied to the knowledge of micronutrients among women of reproductive age.

Predisposing factors

The predisposing factors are behavioural antecedent factors which motivate or provide a reason for certain behaviour. These are factors which must be present prior decision making. They include Knowledge, awareness, attitudes, cultural beliefs, norms, values, perceptions and readiness to change.

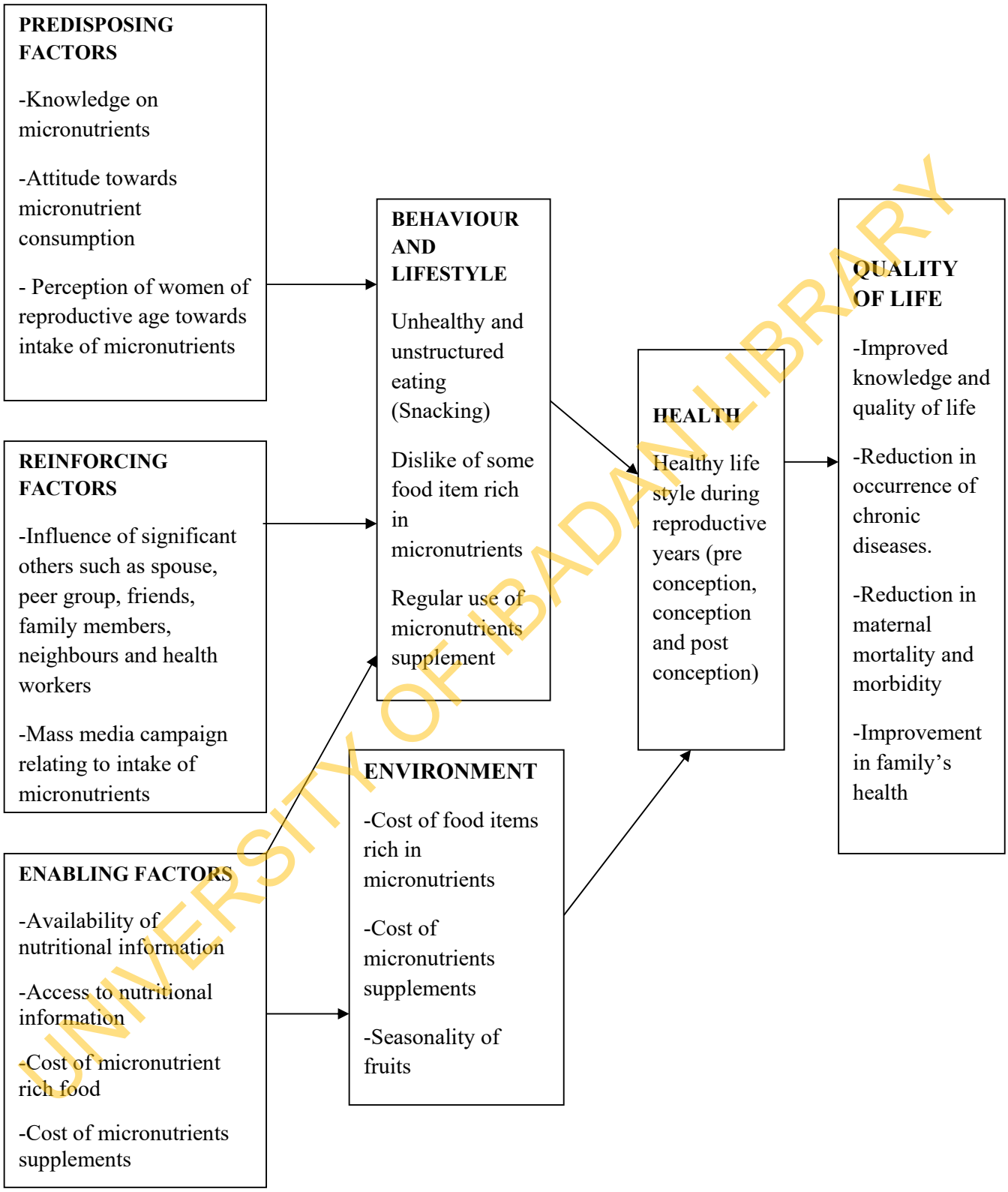
This can be illustrated in a situation where an individual knows that adequate intake of micronutrients would help in maintenance and promotion of good health, this would cause a favourable attitude towards taking recommended micronutrients. In this study, Knowledge as a factor was used in assessing what Female Civil Servants know about importance and sources of micronutrients, effect of micronutrient deficiency and reasons that necessitate use of micronutrient supplements. The perception of micronutrient was also assessed (see Appendix 1).

Reinforcing factors

The reinforcing factors refer to factors that can encourage repetition or persistence of behaviours. Social support, praise, reassurance, and symptom relief might all be considered as reinforcing factors. Factors such as influence of significant others (spouse, peer group, friends, family members, health workers, social media and mass media) can influence the intake of micronutrients among women.

Enabling factors

The enabling factors refer to factors that make any health related behaviour more or less likely to occur. They enable people to act on their predispositions. For this study, these factors includes availability and accessibility of nutritional information, availability of rich sources of micronutrients, cost of micronutrient rich food items and cost of micronutrients supplements. Figure 2.1 shows a schematic representation of PRECEDE model.



Source: Green, Kreuter 1991

Figure 2.1: Application of PRECEDE Model to Knowledge, perception and intake of micronutrients among women of reproductive age

CHAPTER THREE

METHODOLOGY

3.1. Study Design

This study was a descriptive cross-sectional survey. It explored the knowledge, perception and intake of Micronutrients (iron and folic acid) among Female Civil Servants of Reproductive age at the Oyo State Secretariat.

3.2 Study location

The study was carried out at the Oyo State Secretariat, Ibadan, Oyo State, Nigeria. Ibadan, the capital of Oyo State is located in south-western Nigeria. It is the largest indigenous city in Africa with land mass of about1190sqkm (National census populations, 2006) and a projected population of 7.8million by 2016 (National Population Commission) with a Total Fertility Rate of 4.9(NBS-Multiple Indicator Cluster Survey (MICS) 2016/17).

Under the Nigerian 1999 constitution the government of Oyo State, and those of the other 35 Nigerian States, is divided into three branches to be in line with the government of the Federal Republic of Nigeria which is also three tiers: the executive branch, the legislative branch and the judiciary. The executive branch of Oyo State Government is headed by an elected executive governor who presides over the state executive council that is made up of appointed cabinet members. The Oyo State Secretariat serves as the administrative headquarters of the Oyo State Government. It is located at Agodi, Ibadan, Oyo State, Nigeria. There are 37 government parastatals at the State Secretariat which are grouped into Ministries, Department and Agencies (MDAs).

The civil servants in OSS consist of men and women of various socio-demographic characteristic. They have the duty of ensuring implementation of government policies and executing projects for social, economic and political development under the directives of the state government. These job descriptions of civil servants require long working hours, good physical and mental capacity. Deficiencies of several micronutrients, particularly iron, but also vitamin C and folic acid have been found to have negative effect on work capacity.

With such workload and susceptibility to micronutrients deficiencies, women in this field must maintain a good nutritional status.

Table 3.2.1 Distribution of civil servants in the ministries of the Oyo State Secretariat

MINISTRIES AT THE STATE SECRETARIAT		NUMBER OF WORKERS
1	Ministry of Health	245
2	Ministry of Finance	80
3	Ministry of Local Government and Chieftaincy Matters	40
4	Ministry of Youth and Sport	35
5	Ministry of Environment and Habitat	200
6	Ministry of Land, Housing and Physical Planning	529
7	Ministry of Trade, Investment and Cooperatives	109
8	Ministry of Information and Culture	99
9	Ministry of Women Affairs, Community Development and Poverty Alleviation	150
10	Ministry of Education	575
11	Ministry of Works and Transport	508
12	Ministry of Agriculture, Natural Resources and Rural Development	350
13	Ministry of Justice	127
	Total	3047

(Source: Oyo State of Nigeria Book of Estimate, 2017)

3.3 Study Population

The study was carried out among Women of Reproductive Age. This entailed women within the age range of 15 to 49 years old working at the Oyo state secretariat, Agodi, Ibadan. WRA are vulnerable to different health problems. The health risk micronutrient deficiencies posses in women necessitate continuous monitoring of their dietary intake. This study was conducted among this population to investigate their knowledge on micronutrients, its importance, rich sources and effects of its deficiencies.

3.4 Inclusion and Exclusion criteria

3.4.1 Inclusion criteria

- All consenting women of reproductive age (that is women within the age range of 15 to 49 years) currently working at the Oyo State Secretariat

3.4.2 Exclusion criteria

- Female civil servants who are aged of 50 and above.
- Pregnant women who were already placed on micronutrient supplement for the purpose of antenatal care.
- Corpers and IT students were excluded from the study
- Respondents who did not give their consent for voluntary participation were also excluded from the study.

3.5 Sample Size Determination

The study population consisted of female civil servants of reproductive age working at the Oyo State Secretariat, Ibadan. To determine the number of respondents that were used in this survey, the findings of the 2013 Nigeria Demographic and Health Survey (NDHS), implemented by the National Population Commission (NPC) on intake of micronutrients among WRA was used. This proportion was used to calculate the sample size (n) which was determined using the Lwanga and Lemeshow (1991) sample size determination formulae of

$$n = \frac{Z^2 p(1-p)}{d^2}$$

Where n= minimum sample size required

z= confidence limit of survey at 95 %(1.96)

p= prevalence of inadequate intake of micronutrients among women of reproductive age obtained from a survey carried out by the Nigeria Demographic and Health Survey conducted in 2013 (NPC and ICF International, 2014) which is 73%

d= absolute deviation from the true value (degree of accuracy: 5%)

Hence,

$$N = \frac{(1.96)^2 \times 0.73 \times 0.27}{0.05 \times 0.05} = 302.75$$

Adjusting for anticipated 10% non response rate;

$$10\% \text{ of } 303 = \frac{303 \times 10}{100} = 30.3$$

Therefore, 30 was added to sample size calculated to make the sample size 333. A total sample size of 337 was distributed for accuracy.

3.6 Sampling Technique

A multistage sampling technique involving four (4) stages was used for the selection of respondents for this study.

Stage I: All the ministries that formed the core of the civil service were selected to constitute the pool of participants for this study.

Stage II: Proportionate sampling was used to determine the specific number of respondent to be recruited in each ministry. The total number of workers in each ministry was obtained from Oyo State of Nigeria book of Estimate.

A proportionate calculation was done using the formula below

$$\frac{\text{No of civil servants in each ministry}}{\text{Total number of civil servant in the ministries at the State Secretariat}} \times \text{Sample size}$$

Table 3.6.1 Proportionate calculation for sample size determination and number of respondents from each ministry for this study

MINISTRIES AT THE STATE SECRETARIAT		NUMBER OF WORKERS	PROPORTIONATE CALCULATION	RESEARCH RESPONDENT
1	Ministry of Health	245	$\frac{245 \times 337}{3047}$	27
2	Ministry of Finance	80	$\frac{80 \times 337}{3047}$	9
3	Ministry of Local Government and Chieftaincy Matters	40	$\frac{40 \times 337}{3047}$	4
4	Ministry of Youth and Sport	35	$\frac{35 \times 337}{3047}$	4
5	Ministry of Environment and Habitat	200	$\frac{200 \times 337}{3047}$	22
6	Ministry of Land, Housing and Physical Planning	529	$\frac{529 \times 337}{3047}$	58
7	Ministry of Trade, Investment and Cooperatives	109	$\frac{109 \times 337}{3047}$	12
8	Ministry of Information and Culture	99	$\frac{99 \times 337}{3047}$	11
9	Ministry of Women Affairs, Community Development and Poverty Alleviation	150	$\frac{150 \times 337}{3047}$	17
10	Ministry of Education	575	$\frac{575 \times 337}{3047}$	64
11	Ministry of Works and Transport	508	$\frac{508 \times 337}{3047}$	56
12	Ministry of Agriculture, Natural Resources and Rural Development	350	$\frac{350 \times 337}{3047}$	39
13	Ministry of Justice	127	$\frac{127 \times 337}{3047}$	14
	Total	3047		337

(Source: Oyo State of Nigeria Book of Estimate, 2017)

Stage III: Proportionate allocation was used to determine the number of selected respondents across each unit in the Ministries.

Stage IV: A simple random sampling (without replacement) was done to select the respondents from each room within the units.

3.7 Instrument for data collection

A semi- structured, pre-tested, self-administered questionnaire was employed for this study. Information gathered from reviewed literature was used as guide to the design of the questionnaire with adaptation of the three antecedent factors (predisposing, reinforcing and enabling factors) of the PRECEDE model. The instrument was designed to address the objectives of the study.

The structured questionnaire consisted of set questions that were opened-ended. It consisted of six (6) sections.

Section 1: This section contained socio-demographic data such as age, education, designation, marital status, family size, presence or absence of illness.

Section 2: This section was made to assess knowledge of micronutrients (Iron and Folic acid). It contained fourteen open ended questions

Section 3: This section was used to determine the perception of micronutrients among the respondents which could be positive or negative.

Section 4: This section combined the various rich sources of micronutrients (Iron and Folic acid) with the pattern of their intake which could be daily, frequently, rarely or never to determine the intake of dietary iron and folic acid among the respondents.

Section 5: This section was used to assess respondents' intake of Iron and Folic acid supplements and reason(s) for its consumption.

Section 6: This section was used to identify sources of information about micronutrients intake available to the respondents.

Table 3.7.1 Adaptation of the PRECEDE model antecedent factors of a behaviour to the research instrument.

Antecedent factors	Variable
Predisposing factors	Knowledge of micronutrients (definition, functions, sources, effects of deficiencies). Perception of micronutrients (Positive or negative)
Reinforcing factors	Factors associated with micronutrient intake, Reasons that necessitate use of micronutrient supplement(peer pressure, to ensure adequate intake)
Enabling factors	Sources of information on micronutrients (mass media, friends, spouse, family members, health workers, social media)

3.8 Validity of the instrument

Validity of a research instrument assesses the extent to which the instrument measures what it is designed to measure (Robson, 2011). In order to establish the validity of the instrument used, the face and content validity were ensured. Content validity is the extent to which the questions on the instrument and the scores from these questions represent all possible questions that could be asked about the content or skill (Creswell, 2005) while face validity refers to the degree to which a test appears to measure what it claims to measure (Leedy and Ormrod, 2004). Therefore, it was ensured that the questionnaire included adequate set of items that entailed the concept. Relevant literatures were consulted in developing the instrument and variables constructed were compared with other variables and data of previous studies. The variables were matched to the stated objectives, research questions and the set hypotheses of the research. Variables in the theoretical framework were represented in the instrument to ascertain construct validity. The researcher also looked over the instrument for troublesome wordings and employed simple and easy to understand words.

After the construction of the instrument, it was reviewed by peers, lecturers, supervisor and other researchers within the Health Promotion department for thorough review so as to ensure that the items under each section of the questionnaire measured the variable construct.

3.9 Reliability of the instrument

Reliability of an instrument measures consistency, precision, repeatability, and trustworthiness of the research instrument (Chakrabartty, 2013). In quantitative research, the result of a researcher is considered reliable if consistent results have been obtained in identical situations but different circumstances. The most common internal consistency measure is Cronbach's alpha (α). Its value typically varies between 0 and 1, Alpha values above 0.7 are generally considered acceptable and satisfactory, above 0.8 are usually considered quite good, and above 0.9 are considered to reflect exceptional internal consistency (Cronbach, 1951).

To establish the reliability of the research instrument, a pre-test technique was employed. This is a process whereby the research instrument is administered among 10% of the total study population in another representative population. The location for the pretest was the State of Osun Secretariat, Osogbo which shared similar characteristics with the study area. The pretest was conducted on 34 female civil servants of reproductive age which represented

10% of the sample size for the study. The pretest helped to provide insight into respondents' understanding of the items on the questionnaire and also helped in identifying adjustments needed. Copies of pre test questionnaire were coded, entered into the computer and analysed. A Cronbach's Alpha measurement and reliability co-efficient measure was conducted and a Cronbach's Alpha coefficient of 0.87 was obtained, hence the instrument was considered to be reliable.

3.10 Data collection procedure

Three (3) research assistants who were literate, mature and have had previous experience on data collection were recruited and trained by the researcher on the objective of the study and the instrument for data collection. Ethical issues were also discussed as it relates to the research. They helped in administering the questionnaires at the study area which was carried out over a period of three weeks. The questionnaires were administered within the secretariat from 12pm daily. It was a self-administered questionnaire and clarification was sought for on any item on the questionnaire when needed. An informed consent was sought for from the civil servants that partook in the study. The anonymity and confidentiality of the respondents were also kept safe by the research assistance. The questionnaires were tagged with number for accountability. The completed questionnaires were all checked for completeness and collated. After the collection process, the questionnaires were stored in a safe box.

3.11 Data Management and Statistical Analysis

After administering the questionnaire, the principal investigator checked all copies of the questionnaire for the purpose of completeness and accuracy. Collation, editing and sorting of questionnaire were carried out. The editing and sorting involved assigning serial number to each questionnaire for easy identification and data entry. Coding guide for data entry was developed.

Data were entered and managed using SPSS version 21 and were subjected to descriptive (mean, percentages and frequencies) and inferential (Chi square test and Fisher's Exact Test) statistical analyses; the findings were presented in tables and figures. The level of significance was set at $P \leq 0.05$

The overall assessment of knowledge and perception was done by scoring. Knowledge of micronutrients (Iron and Folic acid) was assessed using a 30-point scale. A score of ≤15 was classified as poor knowledge, >15 – 25 as fair and > 25 was classified as good knowledge.

The scoring for perception was done on an 18-point scale where scores ≤ 12 were negative and scores >12 represented positive perception. The hypotheses were tested to establish different level of significant relationship between variables.

3.12 Ethical consideration

Ethics clearance was obtained from the Ministry of Health Ethics Review Committee from Oyo State before the study was conducted. Steps were taken to ensure that all the principles of research were duly adhered to. The content and nature of the research was made known to the respondents. Verbal and written informed consent was obtained from all the respondents. Only respondents who were able to give their consent participated in the study. Respondents were assured of anonymity and confidentiality, hence the questionnaires were identified by serial numbers and not names. Respondents were informed about right of participants such as opportunity to decline participation and non-exposure to risk. The research was also relatively risk free which ensured that the principle of non- maleficience was not violated. The result of the study will serve as a guide in planning appropriate programs for this target group which will promote "Good Health and well-Being" and help to achieve the Sustainable Development Goal 3 of the United Nations. Target 2 of the Sustainable Development Goal 2; end all forms of malnutrition will also be made attainable.

3.13 Limitation of the Study

Some participants did not want to take part in the study because of the open ended section assessing knowledge on micronutrients (Iron and Folic acid). Some felt the questionnaire was built to assess the level of their intelligence and some others did not want to put anything in writing. Respondents were re-assured of anonymity and were informed that the study was solely for research survey. Those who still felt uncomfortable with the assurance were allowed to decline so as to ensure that ethical issues were not violated.

The sufficiency status for micronutrients can be determined by using biomarkers (biological measurement using blood, urine, etc), dietary intake data, or non specific functional indicators, like stunting or low birth weight. The study employed the use of dietary intake data. It assessed the important commonly consumed micronutrient rich food and their frequency of consumption.

The data obtained from this study might only be a representation of South-Western part of Nigeria and not in the other parts of the country.

CHAPTER FOUR

RESULTS

4.1 Socio-demographic characteristics

There were three hundred and thirty seven (337) respondents for this study with a mean age of 35.6 ± 6.9 ranging from 24 years to 49 years. There were 13 ministries represented in this study: Ministries of Agriculture (11.6%), Women Affairs (5.0%), Youth and Sports (1.2%), Trade investment and cooperative (3.6%), Land, housing, survey and urban development (17.2%), Works and Transport (16.6%), Justice (4.1%), Health (8.0%), Education, Science and Technology (19.0%), Information, culture and tourism (3.3%), Finance (2.7%), Environment (6.5%) and local government and chieftaincy matters (1.2%). Majority (71.8%) of the respondents were married with Yoruba ethnicity being the most predominant ethnic group (90.8%). Most (71.5%) of the respondents were from a monogamous family, about one fourth of the respondents had a family size of four (4) and majority (74.5%) of the respondents had tertiary education. A large proportion (42.7%) of respondents have had 3 to 5 years of work experience with some (22.3%) having been diagnosed with anaemia in the last one year and 2.7% admitted to having health problem, the identified health problem included: eye problem, cholera, high blood pressure, ulcer and anaemia (Table 4.1.1).

Table 4.1.1: Socio-demographic information of respondents **(N = 337)**

Variable	Frequency	Percentage
Age+		
24 to 30 years old	97	28.8
31 to 40 years old	149	44.2
41 to 49 years old	91	27.0
Ministry		
Agriculture	39	11.6
Women Affairs	17	5.0
Youth and Sports	4	1.2
Trade investment and cooperative	12	3.6
Land, housing, survey and urban development	58	17.2
Local government and Chieftaincy matters	4	1.2
Works and Transport	56	16.6
Justice	14	4.1
Health	27	8.0
Education, Science and Technology	64	19.0
Information, Culture and Tourism	11	3.3
Finance	9	2.7
Environment	22	6.5
Marital Status		
Never married	10	3.0
Married	242	71.8
Divorced	2	0.6
Widowed	78	23.1
Separated	5	1.5
Ethnicity		
Yoruba	306	90.8
Hausa	9	2.7
Igbo	14	4.1
Others*	8	2.4
Type of family		
Monogamous	241	71.5
Polygamous	96	28.5
Family size		
2	51	15.1
3	71	21.1
4	93	27.6
5	75	22.3
6	19	5.6
7 and more	28	8.3
Education		
Primary	1	0.3
Secondary	50	14.8
Tertiary	286	84.9
Years of Experience		
0 to 2 years	29	8.6
3 to 5 years	144	42.7
6 to 10 years	107	31.8
More than 10 years	57	16.9

* Uhrobo, Ijaw,
+Mean age 35.56 ± 6.911

4.2 Dietary history

Assessing respondents' dietary history for haem-iron, it was found that a higher proportion of the respondents (36.2%) consumed liver occasionally (one to three times in a week), while about two third of the respondents (65.9%) regularly (more than four times a week) consumed meat. Consumption of poultry food items was regular among 37.4% of the respondents while a larger proportion of the respondents (41.2%) had never consumed pork before, unlike sardine fish which was consumed occasionally by 39.8% of the respondents.

Consumption of food items which are good source of non-haem iron was assessed and it was revealed that regular consumption of kidney was low (10.7%) while spinach was consumed by a larger proportion of the respondents (37.7%). Proportion of respondents who consume bitter leaf occasionally (37.1%) was larger compared to regular consumers (18.7%). There were 32.9% and 30% of the respondents who rarely (once in a week) consumed lentils and water leaf, respectively.

Rice consumption was regular by majority of the respondents (72.4%), okro consumption was done regularly by 33.2% and occasionally by 33.8% of the respondents. Four in every ten (42.4%) of the respondents regularly consume noodles while 34.3% regularly consume corn flakes. Citric fruits were consumed regular by more than half of the respondents (59.1%) and a larger proportion of the respondents (36.5%) rarely consume avocado (Table 4.2.1).

Table 4.2.1: Respondents' Dietary History (N =337)

Food Item	Consumption level			
	Regularly (%)	Occasionally (%)	Rarely (%)	Never (%)
Haem-Iron				
Liver	88 (26.1)	122 (36.2)	88 (26.1)	7 (2.1)
Meat	222 (65.9)	60 (17.8)	25 (7.4)	3 (0.9)
Poultry(chicken, turkey)	126 (37.4)	104 (30.9)	67 (19.9)	10 (3.0)
Pork	24 (7.1)	36 (10.7)	102 (30.3)	139 (41.2)
Sardine fish	74 (22.0)	134 (39.8)	87 (25.8)	9 (2.7)
Non-haem Iron				
Kidney bean	36 (10.7)	120 (35.6)	107 (31.8)	34 (10.1)
Spinach	127 (37.7)	110 (32.6)	54 (16.0)	21 (6.2)
Bitter leaf	63 (18.7)	125 (37.1)	102 (30.3)	19 (5.6)
Lentils	26 (7.7)	62 (18.4)	111 (32.9)	97 (28.8)
Waterleaf	76 (22.6)	99 (29.4)	101 (30.0)	31 (9.2)
Folic Acid				
Rice	244 (72.4)	50 (14.8)	12 (3.6)	3 (0.9)
Okro	112 (33.2)	114 (33.8)	60 (17.8)	26 (7.7)
Noodles	143 (42.4)	82 (24.3)	67 (19.9)	14 (4.2)
Corn flakes	116 (34.4)	97 (28.8)	84 (24.9)	13 (3.9)
Citric fruits	199 (59.1)	82 (24.3)	26 (7.7)	1 (0.3)
Avocado	42 (12.5)	70 (20.8)	123 (36.5)	70 (20.8)

Table 4.2.2: Summary of respondents' dietary history (N =337)

Micronutrient	Regularly (%)	Occasionally (%)	Rarely (%)	Never (%)
Haem-Iron	106.8 (31.7)	91.2 (27.1)	73.8 (21.9)	33.6 (10.0)
Non-haem Iron	65.6 (19.5)	103 (30.6)	95 (28.2)	40.4 (12.0)
Folic acid	171 (50.8)	99 (29.4)	74.4 (22.1)	25 (7.5)

4.3 Respondents' Knowledge of Micronutrients

Assessing respondents' definition of dietary iron, a larger proportion of respondents (37.4%) could not coin a sentence to define dietary iron, while 0.6% had no idea, 31.2% also defined it as iron gotten from food, 18.1% defined it as essential micronutrient, 0.9% defined it as essential component of haemoglobin and 1.2% defined it as as a mineral that the human body cannot live without, without enough iron, you may feel tired and develop anaemia. Respondents mean score was determined at 1.0 ± 0.2, indicating a knowledge level of 33.3% (Table 4.3.1)

Respondents' knowledge of the function of iron was found to be 24% which is an indication of poor knowledge. According to the respondents, functions of iron included; prevention of anaemia (5%), growth (8.3%), enhances strength (11.7%) and prevent blood clotting (0.6%) (See table 4.3.1).

Table 4.3.1 revealed the respondents' knowledge of the sources of dietary iron was found to be 35% which is an indication of poor knowledge, most respondents could not mention rich sources of iron as some of the sources revealed included Rice (14.8%), cereals (4.2%), Egg (13.4%), Dark chocolate (2.1%) and Bread (2.8%). Respondents' knowledge of the category of people who need adequate intake of iron was found to be 47%, according to the respondents, categories of people who need adequate intake of dietary iron were people suffering from anaemia (10.4%), people with heart failure (16.2%) and nursing mothers (3.9%) (See table 4.3.2).

Knowledge of the health condition of iron deficiency among the respondents was found to be 25% which is an indication of poor knowledge, respondents did not know health condition of iron deficiency some of the health condition mentioned were intestinal bleeding (15.2%), loss of energy (14%) and weakness (7.9%) (See table 4.3.2).

Table 4.3.1: Respondents' knowledge of dietary iron (N =337)

	Response	Frequency	Percentage
Definition of dietary iron	*Essential micronutrient needed for blood formation	61	18.1
	*Essential component of Haemoglobin	3	0.9
	*It is a mineral found in food that the human body cannot live without; iron is required for blood production.	4	1.2
	This refers to iron gotten from food	105	31.2
	Form of iron that comes from animal sources such as red meat	36	10.7
	No idea	2	0.6
	No response	126	37.4
Function of dietary iron	*Blood formation	60	17.9
	*Anaemia can be prevented with dietary iron	6	1.7
	*It helps in repairing body tissues	7	2.2
	*Transfer of oxygen from lungs to tissues	22	6.6
	*Production of haemoglobin	8	2.5
	It serves as a dietary supplement	19	5.7
	For proper muscle function	9	2.8
	It is used for bone and tooth development	5	1.5
	Essential for respiration and energy metabolism	15	4.5
	It is for body growth	16	4.8
	No Response	168	49.8
Rich Sources Of Dietary Iron	*Sea food	6	1.7
	*Kidney	5	1.5
	*Vegetable	21	6.3
	*Spinach	25	7.6
	*Beans	16	4.9
	*Red meat/ poultry/ liver	34	10.0
	*Plantain	5	1.5
	Cereals	6	1.8
	Potatoes	5	1.4
	Pumpkin seed	2	0.6
	Fish	3	1.0
	Egg	13	3.9
	Peas	4	1.2
	Pastas	2	0.6
	Fruit	7	2.1
	Bread	5	1.5
	Canned clam	2	0.6
	Milk	5	1.5
	Nut	3	0.8
	Rice	16	4.9
	Antibiotics	32	9.4
	No Response	155	34.1

* Correct responses

Table 4.3.2: Respondents' knowledge of dietary iron (N =337)

	Response	Frequency	Percentage
Category of people who need adequate intake of dietary	*People suffering from Anaemia	10	3.0
	*Old people	40	11.7
	*Nursing mothers	8	2.4
	*Premenopausal women	2	0.5
	*People suffering from Sickle cell	2	0.5
	*Pregnant women	72	21.3
	*Women menstruating	30	8.8
	*Frequent blood donors	1	0.3
	*Infant and young children	14	4.0
	Males	5	1.5
	People with kwashiorkor	2	0.6
	People with heart failure	30	8.8
	Hypertensive patients	16	4.6
	No Response	106	31.4
Health conditions of iron deficiency	*Anaemia	86	25.4
	*Nutritional deficiency	4	1.3
	*Weakness	9	2.7
	*Morbidity/ sickness	2	0.7
	*Loss of appetite	7	2.1
	*Loss of weight	1	0.3
	*Irregular heart beat	2	0.5
	*Inhibition of drug metabolism	18	5.2
	*Loss of energy	27	7.9
	*Shortness of breath	9	2.7
	*Dizziness	3	0.9
	Peas	2	0.5
	High Blood Pressure	2	0.7
	Intestinal bleeding	20	5.9
	Poor eye vision	1	0.3
	Bone malformation	1	0.3
	Chronic blood loss	4	1.1
	Tongue swelling	5	1.5
	No Response	131	38.9
Iron supplement	*Additional intake of iron so as to boost the iron in the body	15	4.5
	*Multivitamin supplement with iron	45	13.4
	*Are a number of iron formulations used to treat and prevent iron deficiency	86	25.5
	Replacement of dietary	2	.6
	*Iron extract manufactured to supplement diet either from natural food product or synthetically	33	9.8
	No response	156	46.3

* Correct responses

Table 4.3.3: Respondents' knowledge of dietary iron (N =337)

	Response	Frequency	Percentage
Reasons that necessitate the use of dietary iron	*To supply the body with adequate iron needed for blood formation and proper body functioning	36	10.7
	*It helps the immune system and regulate body temperature	42	12.3
	*Replenishing blood loss	39	11.5
	*When feeling dizzy and palms are white	14	4.2
	*Inadequate dietary iron intake	42	12.6
	*Anaemia	7	1.9
	*To cure sickness	1	.4
	Taking iron supplement helps the body absorb iron faster	1	.4
	*Pregnancy	3	.8
	No response	152	45.2

* Correct responses

Respondents' knowledge of supplementary iron was found to be 54%, which is an indicator of good knowledge (Table 4.3.2). Respondents' knowledge of the reason for use of iron supplement was found to be 20% which is an indication of poor knowledge, some responded that it functions to supply the body with adequate iron needed for blood (13.4%), replenishing the body (11.9%) and helps the body absorb iron faster (0.7%) (Table 4.3.2).

Respondents' knowledge of the sources of folic acid was found to be 34% which is an indication of poor knowledge, respondents did not know sources of folic acid as some mentioned bread (12.8%), rice (18.4%) and cereals (16%), (See table 4.3.4). Respondents' knowledge of the functions of folic acid was found to be 22.6% which is an indication of poor knowledge, respondents did not know functions of folic acid as some mentioned enhance brain health (18.1%), works with vitamin B12 and vitamin C to help the body (15.9%) and enhance strength and gives strong bones (7.7%) (See table 4.3.4).

Respondents' knowledge of the category of people who need adequate intake of folic acid was found to be 34.5% which is an indication of poor knowledge, respondents did not know category of people who need folic acid as some mentioned cancer patients (2.0%), developing children (15.3%) and men (5.3%), (See table 4.3.5). Respondents' knowledge of the health implication of folic acid deficiency was found to be 0.5% which is an indication of very poor knowledge, respondents did not know health implication of folic acid deficiency as some mentioned shortage of blood (5.4%), feeling dizziness (6.9%), birth defect (7.8%) and fatigue (2.9%) (See table 4.3.5). Respondents' knowledge of what is referred to as folic acid supplement was found to be 39% which is an indication of poor knowledge (Table 4.3.6).

Table 4.3.4: Respondents' knowledge of folic acid (N =337)

	Answers	Frequency	Percentage
Definition of folic acid	*This is a type of **vitamin B** normally found in food	161	47.8
	*Man made form of folate that functions with **DNA** and cell formation	14	4.2
	Folic acid is a nutrient that gives strength to the body	13	3.9
	Supplement for pregnant women and women of childbearing age	3	.9
	No response	146	43.3
Rich sources of folic acid	*Vegetables	51	15.2
	*Rice	21	6.3
	*Cereals	12	3.5
	*Okro	2	0.6
	*Peas	3	0.8
	*Fruits	18	5.4
	*Bread	11	3.2
	*Kidney	13	3.8
	*Pastas	36	10.8
	*Eggs	2	0.6
	Meat	5	1.4
	Fish	5	1.6
	Drugs	4	1.3
	Milk	3	1.0
	Vitamin B supplement	16	4.6
	*Liver	13	3.8
	Beans	11	3.3
	No response	107	31.8
Functions of folic acid	*It helps in blood formation and red blood cells	37	11.1
	*It prevents cell malfunction that leads to cancer	15	4.3
	*Prevention of anaemia	4	1.2
	*It helps in boosting the immune system/ prevent disease	10	2.8
	*Enhances speedy recovery	4	1.2
	*Helps tissue grow and cell work	34	10
	*Enhance brain health	17	5
	*Synthesis of nucleic acid (DNA and RNA)	10	2.8
	*It helps younger ones development	2	0.7
	Enhance strength and gives strong bones	13	3.9
	It supplements food nutrient/ vitamin	2	0.7
	Prevention high blood pressure	2	0.6
	Enhance growth	2	0.7
	Prevent hearing loss	7	2.1
	*Acts as coenzyme for enzymatic reactions	8	2.4
	It is important to health	10	2.8
	It is important to be used in the body in early stage of pregnancy	2	0.6
	No response	156	46.2

* Correct responses

Table 4.3.5: Respondents' knowledge of folic acid (N =337)

	Answers	Frequency	Percentage
Category of people needing folic acid supplement	*Pregnant women	122	36.3
	*Nursing mothers	3	1.0
	*Women planning to get pregnant	7	2.1
	*Anaemic patients	8	2.3
	*Cancer patients	6	1.8
	*Developing children/babies	20	5.8
	*Old people	30	8.7
	*Teenagers	3	1.0
	People with Heart disease	2	0.7
	People with Stroke	2	0.5
	Men	14	4.2
	No response	118	35.0
Health implication of folic acid deficiency	*Shortage of blood/ anaemia	29	8.7
	*Fatigue	9	2.6
	*Autism	1	0.3
	*Possible problems with memory and brain function	21	6.1
	*Birth defect	6	1.7
	*Feeling depressed	1	0.3
	Nutritional deficiency	3	0.9
	Poor appetite	2	0.5
	*Cancer	2	0.7
	*Blood loss	1	0.3
	*Deformation of growing cells	4	1.1
	High blood pressure	3	0.9
	Feeling dizziness	15	4.3
	Weak bones	2	0.7
	Pale skin	7	2.1
	Diarrhoea	1	0.3
	Diabetes	2	0.5
	Lack of Immunity	2	0.5
	Pain all over the body	4	1.1
	Male Infertility	18	5.3
	A higher potential long term risk of lower bone density	2	0.5
	Hearing loss	21	6.1
	Nausea	7	2.2
	Gas/ bloating/ intestinal deficiency	2	0.7
	Trouble sleeping	22	6.5
	No response	147	43.5

* Correct responses

Table 4.3.6: Respondents' knowledge of folic acid(N =337)

	Answers	Frequency	Percentage
Folic acid supplement	*Methylfolate	29	8.6
	*A number of **folate formulations** that are water soluble and beneficial	29	8.6
	*Supplements in form of **capsules** taken to boost the level of folic acid in the body	67	19.9
	Vitamin	6	1.8
	*They are **folic acid formulations** used to prevent and treat folic acid deficiency	19	5.6
	Folic acid **found in food**	14	4.2
	No response		51.3

* Correct responses

The overall knowledge of respondents on micronutrient was found at 23.9% (6.9 ± 5.2), furthermore, findings showed that almost all of the respondents (97.9%) had poor knowledge while the remaining 2.1% had fair knowledge and 0% had good knowledge of micronutrients (Fig 4.1)

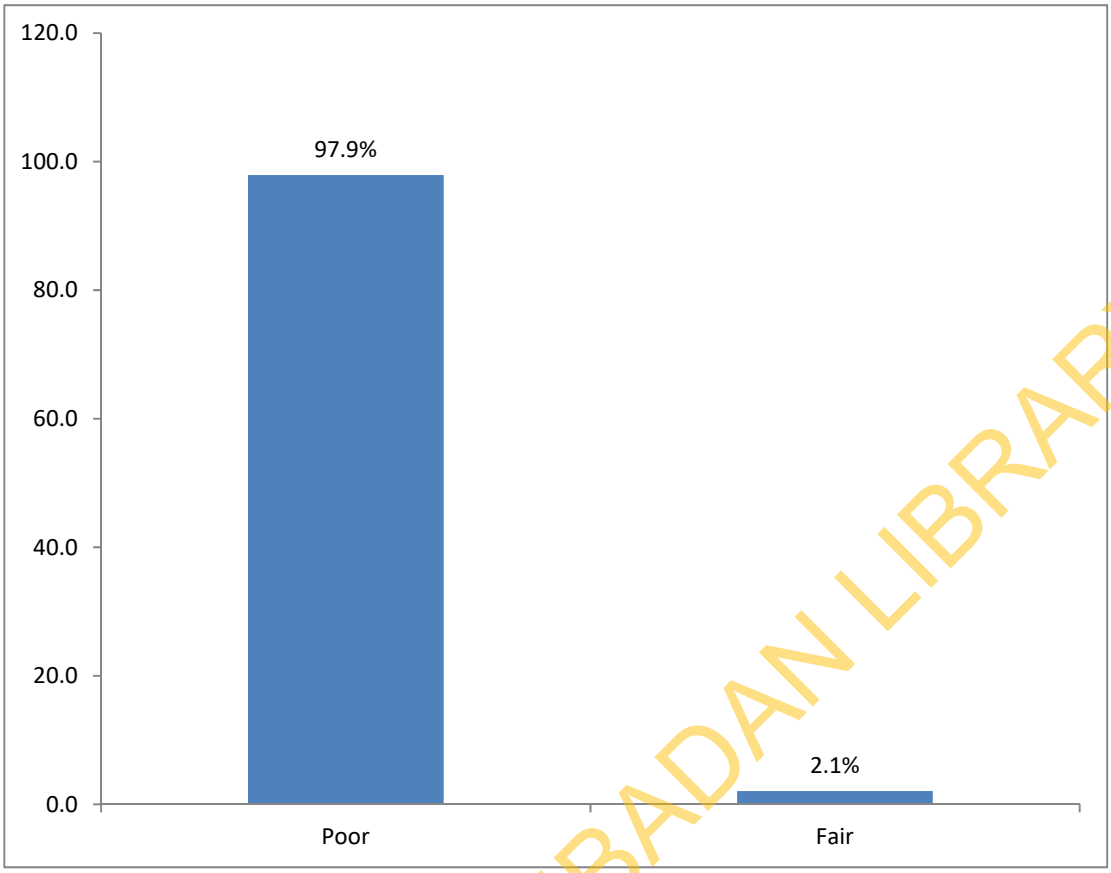


Fig 4.1: Knowledge distribution of respondents

4.4 Perception of Micronutrients among Female Civil Servants at OSS

Majority of the respondents (78.3%) disagreed to no adverse effect being associated with inadequate intake of dietary iron in the body, furthermore, most of the respondent agreed that anaemia can be prevented with adequate intake of dietary iron however 76.3% disagreed that their intake of dietary iron is insignificant to their health status. The statement that constant experience of fatigue may be due to insufficient intake of dietary iron was agreed to by majority of the respondents (76.6%) while a similar proportion of the respondents (79.5%) agreed that sufficient intake of dietary iron constitute to speedy recovery from illness. In addition, 77.4% of the respondents disagreed that adequate intake of dietary Iron is important only during pregnancy and another 82.5% disagreed that only old people need adequate intake of iron.

While there was little difference in the proportion of respondents who agreed (46.3%) and disagreed (47.5%) that taking iron supplement is only needed when recommended daily intake of iron is not met through dietary intake, about two third (63.2%) of the respondents disagreed that the level of education of an individual may determine his or her dietary iron intake, majority of the respondents (78.9%) however agreed that inadequate intake of folic acid can enhance potential risk of anaemia and many of the respondents (61.4%) disagreed that their intake of folic acid is insignificant to my health.

Additionally, 74.5% of the respondents disagreed that only pregnant women are affected with diseases associated with insufficient intake of folic acid, likewise, majority of the respondents (80.7%) agreed that regular consumption of folic acid enhances the capacity of the immune system to fight diseases. Majority of the respondents (73.9%) disagreed that there are no adverse effects associated with insufficient folic acid in the body while 78.3% agreed that sufficient intake of folic acid enhances speedy recovery from illness. Also, most respondents (81.9%) disagreed that only old people needs adequate intake of folic acid. Taking folic acid supplement is needed even when recommended daily intake of folic acid is met through our food intake was agreed to by more than half of the respondents (54.3%) while 57.9% disagreed that the level of education of an individual may determine his or her folic acid. (Table 4.4.1)

Majority 279 (82.8%) of the respondents scored high on an 18-point perception scale while the remaining 17.2% of the respondents had negative perception of micronutrients (Fig 4.2). The mean score of respondents' perception was 14.76 ± 2.23.

Table 4.4.1: Respondents' perception of Micronutrients (N = 337)

Statement	Agree (%)	Disagree (%)
There is no adverse effect associated with inadequate intake of dietary iron in the body	55 (16.3)	*264 (78.3)
Non communicable diseases such as anaemia can be prevented with adequate intake of dietary iron	*293 (86.9)	29 (8.6)
My intake of dietary iron is insignificant to my health status	65 (19.3)	*257 (76.3)
Constant experience of fatigue may be due to insufficient intake of dietary iron	*258 (76.6)	65 (19.3)
Sufficient intake of dietary iron constitute to speedy recovery from illness	*268 (79.5)	50 (14.8)
Adequate intake of dietary Iron is important only during pregnancy	59 (17.5)	*261 (77.4)
Only old people need adequate intake of iron	39 (11.6)	*278 (82.5)
Taking iron supplement is only needed when recommended daily intake of iron is not met through dietary intake	*156 (46.3)	160 (47.5)
The level of education of an individual may determine his or her dietary iron intake	111 (32.9)	*213 (63.2)
Inadequate intake of folic acid can enhance potential risk of anemia	*266 (78.9)	50 (14.8)
My intake of folic acid is insignificant to my health	114 (33.8)	*207 (61.4)
Only pregnant women are affected with diseases associated with insufficient intake of folic acid	75 (22.3)	*251 (74.5)
Regular consumption of folic acid enhances the capacity of the immune system to fight diseases	*272 (80.7)	52 (15.4)
There are no adverse effects associated with insufficient folic acid in the body	73 (21.7)	*249 (73.9)
Sufficient intake of folic acid enhances speedy recovery from illness	*264 (78.3)	58 (17.2)
Only old people needs adequate intake of folic acid	48 (14.2)	*276 (81.9)
Taking folic acid supplement is needed even when recommended daily intake of folic acid is met through our food intake	183 (54.3)	*141 (41.8)
The level of education of an individual may determine his or her folic acid intake	80 (23.7)	*195 (57.9)

* correct responses

Table 4.4.2: Total perception score

Perception score (PS)	N (%)
Poor perception (PS ≤ 12)	58 (17.2)
Good perception (PS > 12)	279 (82.8)
Total	337 (100)

Mean score: 14.76 ± 2.3

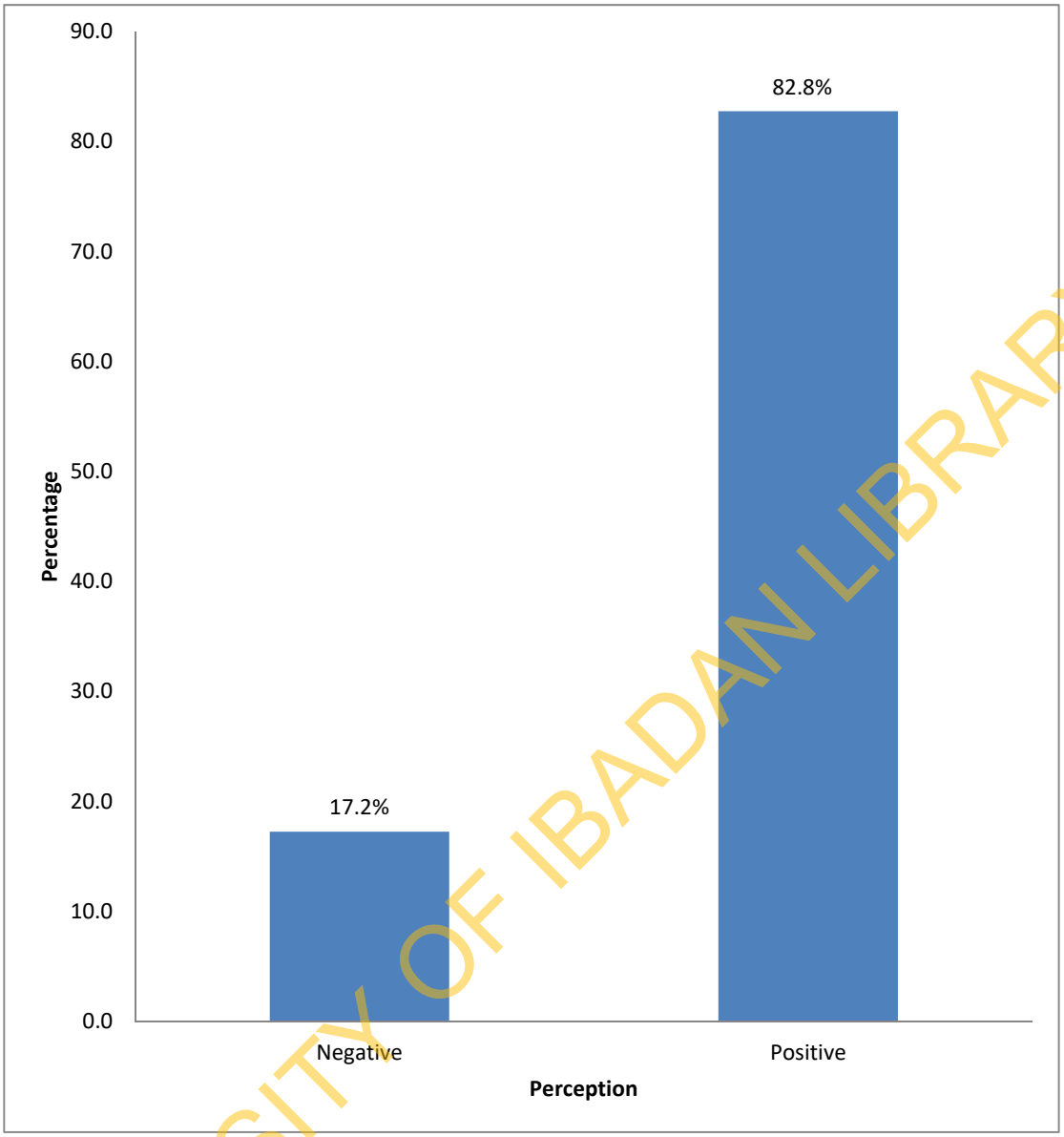


Fig 4.2: Perception distribution of respondents

4.5 Intake of Micronutrients supplement

When asked on how respondents ensured adequate micronutrient intake, while about two third of the respondents (63.8%) did not respond, a large proportion of the respondents (12.2%) responded taking the recommended daily intake of micronutrients, other responses included: by supplementing with food supplements, by taking fruits and vegetables regularly, eating balanced diet, through medical check up, through daily activities and by ensuring regular intake of vitamin rich foods (Table 4.5.1)

Findings revealed that most respondents regularly use multivitamin (70.3%) compared to Folic acid (54.6%) and Iron (47.5%) supplements (Fig 4.3). Fig. 4.3 illustrates the reasons given by respondents on micronutrient uptake, it showed that most of the respondents (85%) use supplement because of inadequate dietary intake followed by pregnancy (12%) (Fig 4.4).

Table 4.5.1: How respondents ensured adequate micronutrient intake (N =337)

Response	Frequency	Percentage
No response	215	63.8%
Take the recommended daily intake of micronutrients	41	12.2%
Eating balanced diet	36	10.7%
Through medical check up	31	9.2%
By supplementing with food supplements	5	1.5%
By taking fruits and vegetables regularly	4	1.2%
Regular intake of vitamin rich foods	4	1.2%
Through daily activities	1	0.3%

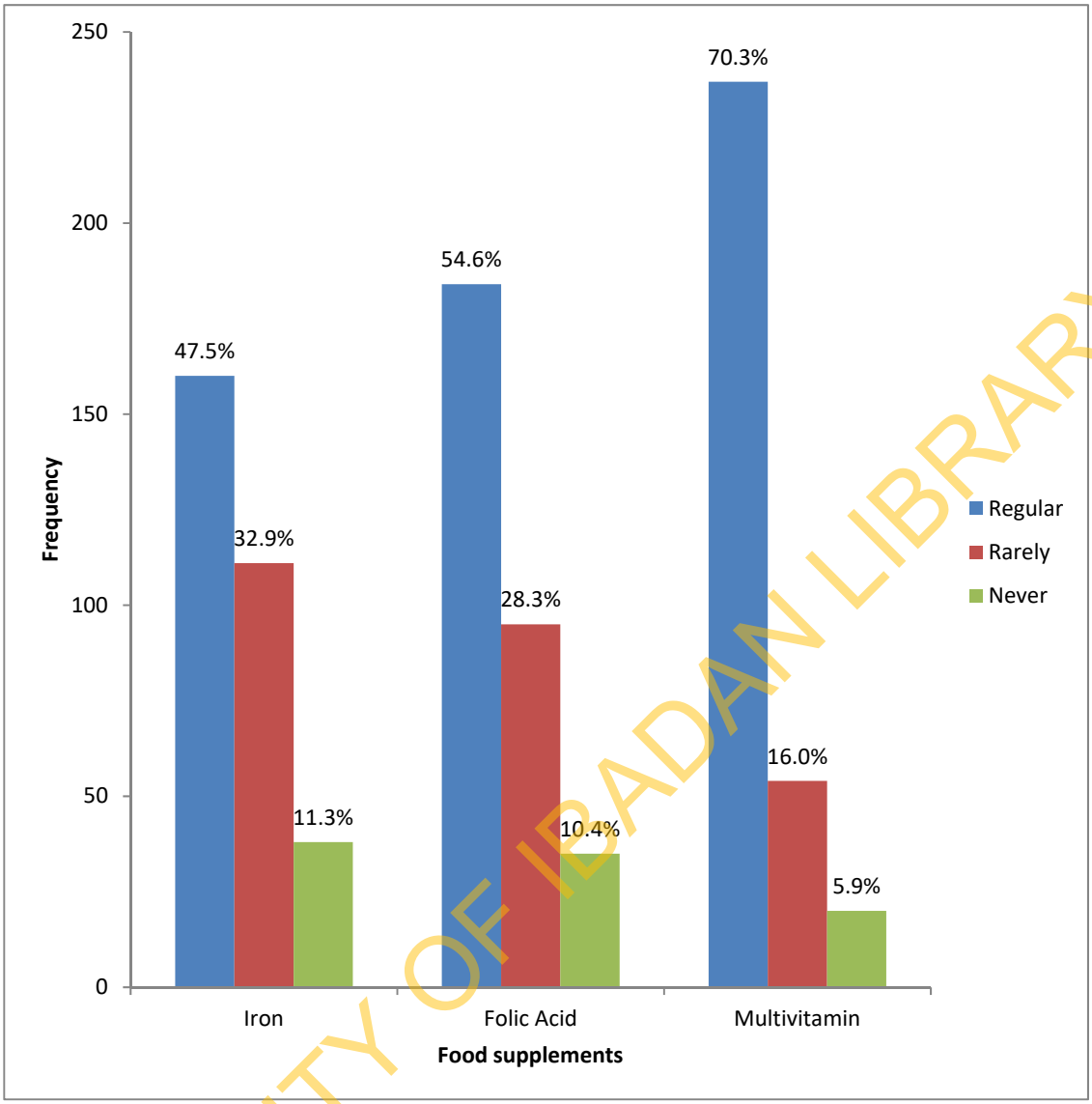


Fig 4.3: Respondents intake of micronutrient supplement

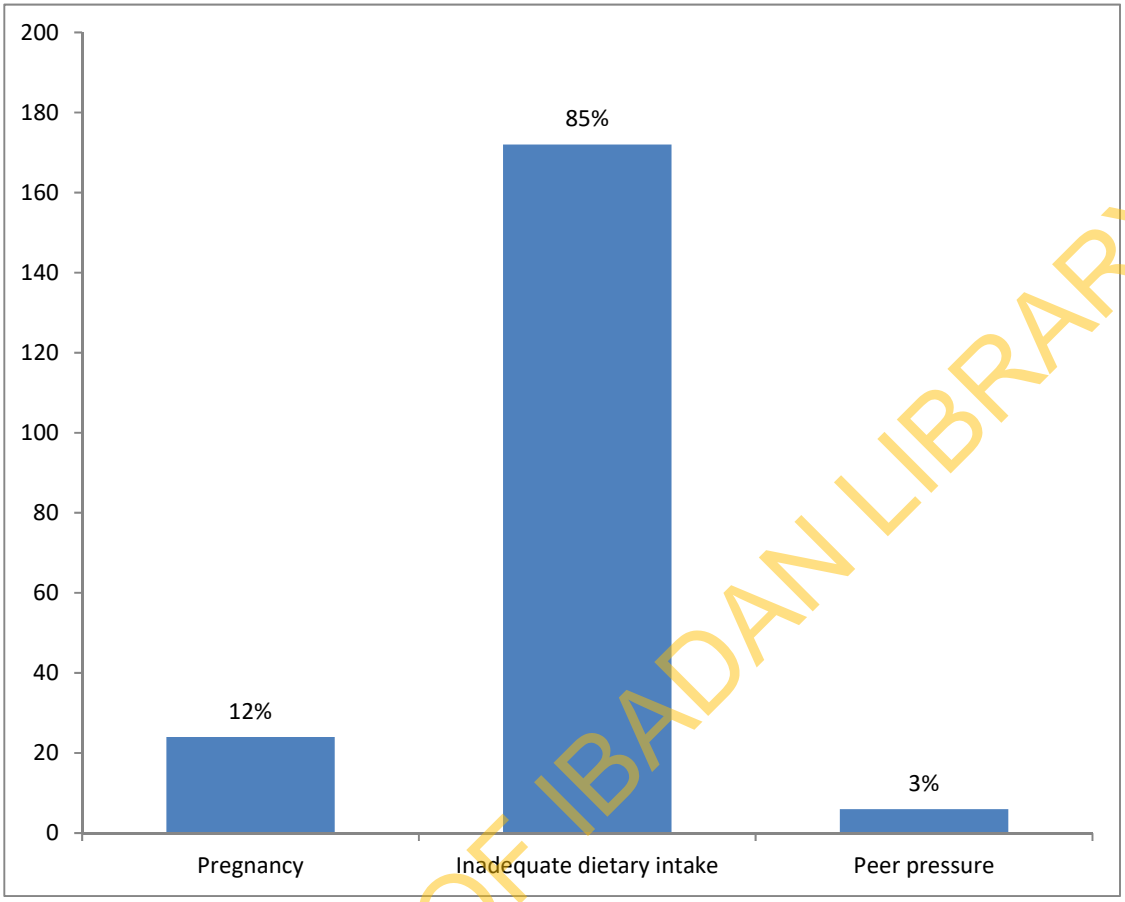


Fig 4.4: Respondents reason for use of micronutrients

4.6 Sources of information on Micronutrients

There were 164 (48.7%) respondents who often acquired information about dietary iron. Often, 11.8% of the respondents are provided with information about dietary Iron by friends and family members. Additionally, a larger proportion of the respondents (36.5%) rarely gathered information about adequate dietary iron intake from trainings, workshop, seminars, etc while 22.6% always acquired knowledge about dietary iron from health organizations.

A large proportion of respondents (45.1%) often acquired information about folic acid, in addition, 34.4% and 32.6% often and rarely have friends and family members who provided them with information about folic acid respectively. Less than 4 in every 10 respondents rarely gather information about recommended folic acid intake from trainings, workshop, seminars, etc while 37.4% often acquire information about folic acid from health organizations. (Table 4.6.1)

Table 4.6.1: Respondents' sources of information on micronutrients (N = 337)

STATEMENT	Always (%)	Often (%)	Rarely (%)	Never (%)
How often do you acquire information about dietary iron	61 (18.1)	164 (48.7)	74 (22.0)	15 (4.5)
I gather information about adequate dietary iron intake from religious institution, social clubs, trainings, workshop, seminars, etc	31 (9.2)	117 (34.7)	123 (36.5)	50 (14.8)
I acquire knowledge about dietary iron from health organizations	76 (22.6)	152 (45.1)	76 (22.6)	16 (4.7)
I obtain information on dietary iron from my friends and family members	45 (11.8)	154 (45.7)	100 (29.5)	30 (9.1)
How often do you acquire information about folic acid	59 (17.5)	152 (45.1)	100 (29.7)	11 (3.3)
My friends and family members provide me with information about folic acid	50 (14.8)	116 (34.4)	110 (32.6)	44 (13.1)
I gather information about recommended folic acid intake from trainings, religious institution workshop, social clubs, etc	35 (10.4)	97 (28.8)	125 (37.1)	65 (19.3)
I acquire information about folic acid from health organizations	60 (17.8)	126 (37.4)	97 (28.8)	35 (10.4)

4.7 Hypotheses Testing

Hypothesis one: There is no significant relationship between level of education and knowledge of micronutrients among female civil servants of reproductive age.

Chi-square test was used in testing this hypothesis. It was found that there was no significant relationship between respondents' level of education and knowledge X^2 (2, N = 337) = 2.686, p =0.608. The null hypothesis is hereby accepted (Table 4.7.1).

Hypothesis two: There is no significant relationship between age and intake of micronutrients among female civil servants of reproductive age.

Chi-square test was used in testing this hypothesis. It was found that there was significant relationship between respondents' age and intake of iron supplement X^2 (6, N = 337) = 12.658, p <0.05. The null hypothesis is hereby rejected (Table 4.7.2.1). It was also found that there was significant relationship between respondents' age and intake of folic acid supplement X^2 (6, N = 337) = 15.638, p <0.05. The null hypothesis is hereby rejected (Table 4.7.2.2).

Hypothesis three: There is no significant relationship between knowledge and intake of micronutrients among female civil servants of reproductive age.

Chi-square test was used in testing this hypothesis. It was found that there was significant relationship between respondents' knowledge and intake of iron supplement X^2 (3, N = 337) = 6.693, p <0.05. The null hypothesis is hereby rejected (Table 4.7.3.1). It was also found that there was significant relationship between respondents' age and intake of folic acid supplement X^2 (3, N = 337) = 8.159, p < 0.05. The null hypothesis is hereby rejected (Table 4.7.3.2).

Table 4.7.1: Test of significant relationship between respondents' level of education and knowledge

Level of education	Level of knowledge			Chi-square test	
	Poor	Fair	Good	Value	P-value
Primary	1 (0.3%)	0 (0.0%)	0 (0.0%)		
Secondary	50 (15.2%)	0(0.0%)	0 (0.0%)	2.686*	0.608
Tertiary	279 (84.5%)	7 (100.0%)	0 (0.0%)		
Total	330	7	0		

* Fisher's Exact Test used

Table 4.7.2.1: Test of significant relationship between respondents' age and iron supplement intake

Age	Iron supplement intake			Chi-square test	
	Regularly	Rarely	Never	Value	P-value
24 to 30 years	54 (33.8%)	24 (21.6%)	10 (26.3%)		
31 to 40 years	64 (40.0%)	54 (48.6%)	14 (36.8%)	12.658	0.049
41 to 49 years	42 (26.3%)	33 (29.7%)	14 (36.8%)		
Total	160	111	38		

Table 4.7.2.2: Test of significant relationship between respondents' age and folic acid supplement intake

Age	Folic acid supplement intake			Chi-square test	
	Regularly	Rarely	Never	Value	P-value
24 to 30 years	53 (28.8%)	24 (25.3%)	11 (31.4%)		
31 to 40 years	84 (45.7%)	42 (44.2%)	9 (25.7%)	15.638	0.016
41 to 50 years	47 (25.5%)	29 (30.5%)	15 (42.9%)		
Total	184	95	35		

Table 4.7.3.1: Test of significant relationship between respondents' knowledge and iron supplement intake

Level of knowledge	Iron supplement intake			Chi-square test	
	Regularly	Rarely	Never	Value	P-value
Poor	159 (99.4%)	108 (97.3%)	35 (92.1%)		
Fair	1 (0.6%)	3 (2.7%)	3 (7.9%)	6.693*	0.043
Good	0 (0.0%)	0 (0.0%)	0 (0.0%)		
Total	160	111	38		

* Fisher's Exact Test

Table 4.7.3.2: Test of significant relationship between respondents' knowledge and folic acid supplement intake

Level of knowledge	Folic acid supplement intake			Chi-square test	
	Regularly	Rarely	Never	Value	P-value
Poor	183 (99.5%)	92 (96.8%)	32 (91.4%)		
Fair	1 (0.5%)	3 (3.2%)	3 (8.6%)	8.159*	0.024
Good	0 (0.0%)	0 (0.0%)	0 (0.0%)		
Total	184	95	35		

* Fisher's Exact Test

CHAPTER FIVE

DISCUSSION, CONCLUSION AND RECCOMENDATION

DISCUSSION

5.1. Socio-demographics characteristics

The socio demographic data presented in table 4.1.1 which formed the background characteristics of participants in the study consisted of age, ministry, designation, marital status, ethnic group, level of education, years spent on job and personal health problem. The mean age of respondents was 35.56 ± 6.911 while majority of the respondents were in their 30's. The three major ethnic groups in Nigeria were not well represented in the state civil service, virtually all the respondents were from the Yoruba ethnic group. This may be due to the fact that the study was conducted in Oyo State, part of the south-western Nigeria which is predominately a Yoruba speaking area.

Data on marital status of respondents showed that seven out of every ten WRA were married. This corroborates a study conducted at the Oyo State Secretariat where four out of every five civil servants that were interviewed were married (Adenugba, Fadoju, Akhuetie, 2017). This was not surprising as most of the respondents were in their middle ages where most women are culturally expected to be married. The educational categorizations showed that majority of the respondents were graduates. Most of the respondents were from a monogamous family. This may be attributed to civilization in the study area. Very few respondents admitted to been diagnosed with anaemia in the last one year and other self-reported health problem included: eye problem, shortage of blood, nutritional deficiency, cholera, high blood pressure, ulcer and anaemia. Presence of these health challenges might be due to micronutrient deficiencies among the respondents.

5.2 Knowledge of Micronutrients

A key finding in this study is that the level of knowledge of MNs among the respondents was found to be low. This could probably be due to the influence of insufficient nutritional information and low level of exposure to healthy eating. This finding is similar to a cross-sectional study that was carried out among Kansas women by Glynda, Sharp, Lorenda, Nylor, Jinwen, Melissa, Hyder, Pradeep, Chandra and James, G which reported the awareness of Micronutrients as 46.3% and good knowledge was found to be 6.3% among respondents. Similarly, a study by Gallup (2008) revealed a high level of awareness but about 90% of women had low level of Micronutrient intake. A high level of awareness was also found

among women in Saudi Arabia on micronutrient but contrary to this study, knowledge was high, this was especially high however among university graduate (Alblowi *et al,* 2018). Contrary to this is a finding by Alblowi *et al.* (2018) and Keshavari *et al.,* (2016), where higher educational level was related to higher knowledge.

In addition, van Ejisden *et al.,* (2006) revealed that peri-conceptional folic acid knowledge was significantly lower among Ghanaian, Moroccan, Turkish, and other non-Western women than among women born in the Netherlands or other Western countries, establishing a disparity in the knowledge level across developing and developed countries. This brings to light the gap in knowledge as opined that language proficiency was determined as a major determinant of knowledge while educational attainment was of secondary importance.

Comparing findings of this study to another study carried out in Libya, it was shown that majority of the participants had heard about folic acid but only a few could correctly identify the effect of folic acid when used periconceptionally (Abdulmalek, 2017). In another study in India, knowledge about food rich in iron was poor among the pregnant women.

Most of the respondents of this study could not mention rich sources of Iron. Similarly, In a study by Kabir et al, 2010 on dietary pattern, nutritional status and anaemia- related knowledge in urban adolescent college girls of Bangladesh, majority of the participants (73.8%) had no idea about the sources of iron rich foods

In establishing the knowledge of respondents on health conditions associated with inadequate folic acid intake, only few of the respondents were able to identify the health conditions. This was contrary to findings from an Australian study by Mani *et al.* (2014) where majority of the women identified health condition to be associated with inadequate intake of folic acid, however, women's knowledge of dietary sources of folic acid and iodine was limited as against the high level of knowledge recorded on food sources of folic acid in this present study.

Respondents' knowledge on the benefits and functions of folic acid was limited in this study, this is similar to a Puerto Rican study, where most of the women understood that the best time to start FA supplementation was prior to conception, but many could not identify all of FA benefits. (Rivera-Segarra *et al.,* 2016).

The result of data analysis showed that there was no significant relationship between respondents' knowledge of micronutrients and educational level. This observation might be

because majority of the respondents attained tertiary education. As the largest category, this might have overshadowed the other categories.

5.3 Perception of Micronutrients

Findings from this study showed that majority of the respondents had positive perception of micronutrients. This could be the reason for high consumption of Micronutrients supplement among respondents.

However, there are limited studies on perception of Micronutrients to compare this result with . Taye *et al.,* (2015) reported that women belief that too many tablets would harm the baby and fear of side effects were the major reasons given for noncompliance. Furthermore, age of the mother, educational status of the mother, knowledge of anaemia and iron folate tablets, and history of anaemia during pregnancy were significantly associated with compliance to iron folate supplementation.

5.4 How respondents ensured adequate micronutrient intake

Most of the respondents did not know how to ensure adequate intake of Micronutrients. However, the five most frequent ways by which respondents ensured adequate intake of micronutrients in this study included eating balanced diets, use of supplements, regular intake of fruits and vegetables, adherence to recommended daily intake of micronutrients and through medical check up. A possible reason for the wrong responses and poor knowledge on how to attain regular intake of Micronutrients could be attributed to lack of adequate information on micronutrients.

5.5 Intake of Micronutrients

The findings from this study revealed that haem Iron, non- haem iron and folic acid was consumed regularly by 31.7%, 19.5% and 50.8% of the respondents respectively. This correlates with the findings of a health survey on Dietary intake patterns and nutritional status of Women of Reproductive Age in Nepal that showed the majority of women in all the eco-logical regions consumed meat and fruits once a week (Bhandari, Sayami, Thapa, Kande and Banjara, 2016) and the frequency of consumption of meat and fruits was found to be once a week in 31.9% and 33.0% of women in India (Padmadas, Dias and Willekens. 2006).

Low consumption of food rich in Micronutrients might be associated with poor knowledge of food items rich in Micronutrients, barriers to access these food items such as, unavailability, unaffordability and dislike of certain food.

Intake of micronutrients supplement was high among respondents with more than half of them regularly (more than 4 times a week) taking folic acid and iron supplements. However, intake was found to be significantly related to respondents age. Majority of female civil servants within the age range of 31 to 40 years consumed supplements the most. This could be because these women were aware of the perceived benefits of iron-folic acid supplements. This finding was significantly higher than the reported 26% of women who took folic acid every day prior to pregnancy in the United State (Meyer *et al.,* 2011). Meyer *et al.* (2011) further revealed that mothers who were older, better educated, married, and had higher incomes were most likely to have heard about folic acid and to have taken it every day before pregnancy, an opinion also shared by Keshavari *et al.,* (2016).

The regular intake of iron supplement was similar to findings by Nivedita *et al.,* (2016) in India where it was found that 74.36% claimed to have taken iron supplementation regularly whereas 9.8% had not taken iron supplementation (Nivedita and Fatima, 2016).While level of knowledge is low among women, use of micronutrient supplements was significantly influenced by ethnicity, age, education level, employment and family income as reported by Hassan *et al.,* (2008).

The findings therefore revealed that there is low consumption of dietary micronutrients while supplement consumption is high. The public health concern about this is that women included in this study tend to be dependent on supplement to obtain nutrients which could ordinarily be obtained from food.

5.6 Reasons for use of micronutrient supplement

Findings on reasons that require use of micronutrient supplement showed that majority of the respondents agreed that supplement use is needed when there is an inadequate dietary intake. This is in accordance with the findings of Nisar, Alam, Aurangzeb and Dibley, 2014 where most of the respondents took supplements to ensure that RDI is meant.

5.7 Sources of information on micronutrient

In the United States of America, approximately 77% of all women had heard or read about the benefits of folic acid. Just slightly over one-half of all women reported that they had heard about folic acid from their doctor or health care provider (Meyer *et al.,* 2011) this was often the case among respondents within this study who had received information from health organizations, trainings, workshop and seminars. Keshavari *et al.,* (2016) also reiterated that majority of women were informed about folate by physicians or obstetricians.

In another study in India, at least 20% of the participants had not received educational information regarding anaemia from any source (Nivedita and Fatima, 2016).

5.8 Implication of findings for Health Promotion and Education

From findings gathered from this study, it is evident that women recruited for this study had poor knowledge of micronutrients and consumed food rich in micronutrients inadequately. There is an urgent need for multiple interventions to tackle this hidden hunger.

There is an apparent poor knowledge of micronutrients among the respondents. Lack of awareness of nutritional facts and information about micronutrients could hinder adequate consumption thereby making women more prone to micronutrients deficiencies. Hence, creating awareness about these micronutrients is essential. Nutritional information and health message should be channelled to this group of women through television, radio, and billboard.

Nutritional education should be given to health care providers. This will provide them with updated information about the current status of micronutrient deficiency among women of reproductive age and equip them with adequate skills to reach out to these women and enable them to improve their intake of micronutrients. Proper recommendation of micronutrients when needed will also be ensured.

Education on dietary supplement is required as most of the respondents (Fig 4.3) took supplement regularly. It is important to emphasise that food supplement is only to complement nutrients found in food when intake is less than the recommendation and should never be used when recommended intake is met. Public health education about food supplement, reasons that necessitate supplement use and adverse effect of excess use should be promoted.

Low proportion of religious personnel provided information about micronutrients to the respondents. This however can be improved with the introduction of health talks and educational intervention in different religious institutions at both the Christianity and Islam religion. Religious settings have been found to be a very organized setting to implement health promotion programs with a high recruitments success of volunteers, including: members in health professions and influential personnel at high position of respect with higher chances of impacting others.

5.9 Conclusion

This study investigated the knowledge, perception and intake of Micronutrients among Female Civil Servants of Reproductive age at the Oyo State Secretariat, Ibadan. Findings showed that majority of the respondents had poor level of knowledge on micronutrient. While respondents' perception was found to be positive, less than one-third of respondents consumed dietary iron regularly but intake of folic acid was regular among 50% of the respondents. Hence, there is inadequate intake of micronutrient rich food among the study group. Intake of folic acid and iron supplements was found to be high, subjected to the influence of respondents' age and level of knowledge. Access to information on micronutrients is inadequate among the respondent but sources of information on micronutrients among respondents included workshop, seminars and health workers.

There is an urgent need to educate and motivate women of child bearing age regarding this hidden hunger so as to address the gap identified in knowledge and dietary consumption of these nutrients.

5.10 Recommendations

Based on findings from this study, the following are recommended:

1. There is a need to provide basic nutritional information among female civil servants at the Oyo State Secretariat. The Ministry of health should be encouraged to employ the use of mHealth. mHealth (mobile health) refers to the use of mobile phones and other wireless technology in medical care. Therefore, this can be used to educate women of reproductive age about micronutrients and food rich in Micronutrients. Other preventive health care services, treatment support and chronic disease management could also be channelled to the women through this medium.
2. Ministry of agriculture should be encouraged to produce food rich in Micronutrients. The state government should allocate a conducive location to the Ministry of Agriculture to

facilitate this. Sales of their products will also serve as a source of income to the government. Ministry of Agriculture can also collaborate with the ministry of trade and commerce to invite farmers that produces food rich in micronutrients to start selling within the secretariat at an affordable price and provide a selling point for them.

3. There is need for exploratory investigation into understanding women's beliefs and myth on drug use and how it influences their intake of dietary supplements.
4. There is need for detailed educational intervention aimed at non-pregnant women in improving the intake of iron and folic acid while emphasising on the benefits and importance.

REFERENCES

Abdumalek, L. J. 2017. Knowledge, Attitude and Practice Regarding Folic Acid among Pregnant Women in Benghazi, Libya.*Ibnosina J Med BS.* 9(3), 67-71

Abdelmonem, S. H., and Al-kharusi, B. M. 2008. Knowledge and use of folic acid among pregnant Arabian women residing in Qatar and Oman. *International Journal of Food Sciences and Nutrition,* 59 1): 70-79

Alblowi, S. A., and Alomayri, M. H. 2018. Assessment of Knowledge, Awareness, and Behavior of Folic Acid Use among Females during The Childbearing Period in Tabuk City-2017. *The Egyptian* Journal of Hospital Medicine. 70 (7), 1242-1247

Aletor, V. A., and Omodara, O. A. 1994. Studies on some leguminous browse plants, with particular reference to their proximate, mineral and some endogenous anti-nutritional constituents. Anim. Feed Sci. Technol. 46: 343-348

Allen, L. H., and Casterline-Sabel, J. E. 2000. Prevalence and causes of nutritional anemias. In: Ramakrishnan U, ed. Nutritional Anemias. Boca Raton, FL, CRC Press, 17–21.

Asobayire, F .S., Adou, P., Davidsson, L., Cook, J .D., and Hurrell, R.F. 2001. Prevalence of iron deficiency with and without concurrent anaemia in population groups with high prevalence of malaria and other infections: a study in Côte d'Ivoire. The American Journal of Clinical Nutrition, 74(6):776–782.

Bailey, L.B., and Caudill M .A. 2012. Folate. In: Erdman JW, Macdonald IA, Zeisel SH, eds. Present Knowledge in Nutrition. 10th ed. Washington, DC: Wiley-Blackwell, 321-42.

Bailey, R. L., West K. P., and Black, R. E. 2015. The epidemiology of global micronutrient deficiencies. Ann NutrMetab. 2015;66Suppl 2:22-33

Bailey, L.B., Stover, P.J, McNulty, H., Fenech, M.F., Gregory, J.F., Mills, J.L., Pfeiffer, C.M., and Fazili, Z. et al. 2015."Biomarkers of Nutrition for Development—Folate Review." The Journal of Nutrition, June, jn206599. doi:10.3945/jn.114.206599

Bansal, R.D., and Mehra, M. 1999. Malnutrition: A silent emergency. Ind J Public Health, XXXXIII(1): 2-3.

Berg, M. J. 1999. The importance of folic acid. J GendSpecif Med, 2(3):24-8

Bitzer, J., von Stenglin, A., and Bannemarschult, R. 2013. Women's awareness and periconceptional use of folic acid: data from a large European survey. *International Journal of Women's Health.*5, 201-213

Block, G., Jensen, C. D., Norkus, E. P., Dalvi, T. B., Wong, L. G., McManus, J. F., and Hudes, M. L. 2007. Usage patterns, health and nutritional status of long-term multiple dietary supplement users: a cross-sectional study. Nutrition Journal 6:30

Brabin, B .J., Hakimi, M., and Pelletier, D. 2001. An analysis of anemia and pregnancy-related maternal mortality. Journal of Nutrition, 2001, 131 (2S-2):604S–614S.

Brabin, B .J., Premji, Z., and Verhoeff F. 2001. An analysis of anemia and child mortality. Journal of Nutrition, 2001, 131 (2S-2):636S–645S.

British Dietetics Association. 2016. Folic Acid. Food Fact Sheet www.bda.uk.com/foodfacts

Brownlie, T., Utermohlen, V., Hinton, P.S., Giordano, C., and Haas, J. D. 2002. Marginal iron deficiency without anemia impairs aerobic adaptation among previously untrained women. American Journal of Clinical Nutrition, 75:734–742.

Carmel, R. 2005.Folic acid. In: Shils M, Shike M, Ross A, Caballero B, Cousins RJ, eds. Modern Nutrition in Health and Disease. 11th ed. Baltimore, MD: Lippincott Williams and Wilkins, 470-81.

Chakrabartty, S. N. 2013. Best Split-Half and Maximum Reliability. IOSR Journal of Research and Method in Education, 3(1), 1-8

Chandyo, R. K., Ulak, H. M., Thome-Lyman, A. L., Ulvik, R. J., Shrestha, P. S., Locks, L., et a. 2016. The prevalence of iron-deficiency anemia is more common among breastfed infants than their mothers in Bhaktapur, Nepal. Macmillan Publishers, 70,456-462.

Cravo, M .L, and Camilo M.E. 2000.Hyperhomocysteinemia in chronic alcoholism: relations to folic acid and vitamins b6 and b12 status. Nutrition. 16 (4) 296 – 302

Creswell, J. W. 2005. Educational Research: Planning, Conducting and Evaluating Quantitative and Qualitative Research (2nd Ed.). Pearson Merrill Prentice Hall.

Cronbach, L. J. 1951. Coefficient Alpha and the Internal Structure of Tests. Psychometrika, 16, 297–334

Deniz , B. F., Confortim, H. D., Deckmaann, I., Miguel, P. M., Bronauth, L., Oliverira, B. C., Barbosa, S., Cechinel, L. R., Siqueira, I. R., and Pereira L. O. 2018. Folic acid supplementation during pregnancy prevents cognitive impairments and BDNF imbalance in the hippocampus of the offspring after neonatal hypoxia-ischemia. The Journal of Nutritional Biochemistry, Volume 60, Pages 35-46

Donahue, A. M., Berti, P., Siekmans, K.., Tugirimana, P. L., and Boy, E. 2017. Prevalence of Iron Deficiency and Iron Deficiency Anemia in the Northern and Southern Provinces of Rwanda.Food Nutr Bull, 38(4):554-563

Dupont, C. 2017. Prevalence of iron deficiency. Arch Pediatr, 24(5):45-48

El-Kadi, M. A., and Farag, A. F. 2014. The effect of folic acid supplementation on serum homocysteine of Egyptian postmenopausal women: A randomized controlled trial. Middle East Fertility Society Journal, Volume 19, Issue 3, Pages 192-196

El-Mani, S., Charlton, K. E., Flood, V. M., and Mullan, J. 2014. Limited knowledge about folic acid and iodine nutrition in pregnant women reflected in supplementation practices.*Nutrition and Dietetics,* 71 (4), 236-244.

Fasola, O., Olayinka, A., Foluke, A., and Fasola. 2018. Knowledge, attitude and practice of good nutrition among women of childbearing age in Somolu Local Government, Lagos. Journal of Public Health in Africa 2018; volume 9:793

Food and Agriculture Organisation, International Fund for Agricultural Development and World Food Programme. 2015. The State of Food Insecurity in the World 2015.Meeting the 2015 International Hunger Targets: Taking Stock of Uneven Progress. Rome: FAO; 2015.

Food and Agriculture Organisation and World Health Organisation. 2014 Rome Declaration on Nutrition. Why it matters and what can be done. Second International Conference on Nutrition (ICN2), 2014. http://www.fao.org/assets/infographics/FAOinfographic-ICN2-RomeDeclaration-en.pdf. [2016-07-22]

Food and Agriculture Organisation and World Health Organisation. 2001. Human Vitamin and Mineral Requirements. Food and Agriculture Organisation and World Health Organisation; Rome, Italy: 2001

Food and Nutrition Board. 2001: Dietary Reference Intake for Vitamin A, Vitamin K, Arsenic, Boron, Chromium, Copper, Iodine, Iron, Manganese, Molybdenum, Nickel, Silicon, Vanadium, and Zinc. Washington, National Academy Press, 2001

Fuchs, C. S., Willett, W. C., Colditz, G. A, Hunter, D. J., Stampfer, M. J., Speizer, F. E., and Giovannucci, E. L. 2002. The influence of folate and multivitamin use on the familial risk of colon cancer in women. Cancer Epidemiol Biomarkers Prev 2002;11:227-34 https://www.ncbi.nlm.nih.gov/pubmed/11895870

Gallup. 2008. Improving Preconception Health: Women's Knowledge and use of Folic Acid. *March of dimes.*

Garcia, B. A., Luka, Z., Loukachevitch, L. V., Bhanu, N. V., and Wagne, C. 2016. Folate deficiency affects histone methylation. Medical Hypotheses, 88, 63-67

García-Casal, M. N., Osorio, C., Landaeta, M., Leets, I., Matus, P., Fazzino, F., and Marcos, E. 2005. High prevalence of folic acid and vitamin B12 deficiencies in infants, children, adolescents and pregnant women in Venezuela.Eur J ClinNutr. 2005 Sep;59(9):1064-70.

Garcia-Closas, R., Castellsague, X., Bosch, X., and Gonzalez, C. A. 2005. The role of diet and nutrition in cervical carcinogenesis: a review of recent evidence. Int.J.Cancer 11-20-2005;117(4):629-637

Getachew, M., Abay, M., Zalalem, H., Gebremedhin, T., Grum, T., and Bayray, A. 2018. Magnitude and factors associated with adherence to Iron-folic acid supplementation

among pregnant women in Eritrean refugee camps, northern Ethiopia. BMC Pregnancy and Childbirth 18:83

Gibson, R. S. 2004. Strategies for preventing micronutrient deficiencies in developing countries. Asia Pacific Journal of Clinical Nutrition, Vol. 13, pS23-S23. 1p.

Glynda, F., Sharp. Lorenda, A., Nylor. Jinwen, C. Melissa, L. Hyder. Pradeep, Chandra, V., and James, G. 2008. Assessing awareness, knowledge and use of folic acid in Kansas women between the ages of 18 and 44 years. Matern Child Health J (2008) 13:814-821 DOI 10.1007/s10995-008-0414-5. Published online: 23 September 2008

Goel, S., and Messerli, F. H. 2015. Efficacy of folic acid in primary prevention of stroke among patients with hypertension in China. Journal of the American Society of Hypertension, Volume 9, Issue 9, Pages 665-667

Green, L., and Kreuter, M. 1991. Health Promotion Planning. (2nd Edition).

Haidar, J. 2010. Prevalence of Anaemia, Deficiencies of Iron and Folic Acid and Their Determinants in Ethiopian Women. J Health PopulNutr, 28(4): 359–368

Hall, J. N., Moore S., Harper, S. B., and Lynch, J. W. 2009. Global variability in fruit and vegetable consumption. Am J Prev Med 2009:36;402-9

Harika, R., Faber, M., Samuel, F., Kimiywe, J., Mulugeta, A., and Eilander, A. 2017. Micronutrient Status and Dietary Intake of Iron, Vitamin A, Iodine, Folate and Zinc in Women of Reproductive Age and Pregnant Women in Ethiopia, Kenya, Nigeria and South Africa: A Systematic Review of Data from 2005 to 2015. Nutrients, 5;9(10). pii: E1096.

Harrison, G. G. 2010. Public health interventions to combat micronutrient deficiencies. Public Health Reviews. 30 (1): 256-266

Hassan, A. S., and Al-Kharusi, B. M. 2008. Knowledge and use of folic acid among pregnant

Ho G-T., Boyapati, R., and Satsangi, J. 2015.Ulcerative colitis. Medicine, 43 (5) 276 - 281 https://www.sciencedirect.com/science/article/pii/S1357303915000456

Ho, R. C., Cheung, M. W., Fu, E., Win, H. H., Zaw, M. H., Ng, A., and Mak, A. 2011. Is high homocysteine level a risk factor for cognitive decline in elderly? A systematic review, meta-analysis, and meta-regression.Am J Geriatr Psychiatry, 19:607-17.

Henderson, L., Irving, K., and Gregory, J. 2003. The National Diet and Nutrition Survey: Adults Aged 19–64 Years. Volume 3: Vitamin and Mineral Intake and Urinary Analytes. HMSO, London

Institute of Medicine. 1998. Food and Nutrition Board. Dietary Reference Intakes: Thiamin, Riboflavin, Niacin, Vitamin B6, Folate, Vitamin B12, Pantothenic Acid, Biotin, and Choline. Washington, DC: National Academy Press.

Institute of Medicine. 2001. Food and Nutrition Board. Dietary Reference Intakes for Vitamin A, Vitamin K, Arsenic, Boron, Chromium, Copper, Iodine, Iron, Manganese, Molybdenum, Nickel, Silicon, Vanadium, and Zinc: a Report of the Panel on Micronutrients external link disclaimer. Washington, DC: National Academy Press.

Jan D.van Gool, Herbert Hirche, Hildegard Lax, and Luc De Schaepdrijver. 2018. Folic acid and primary prevention of neural tube defects: A review. Reproductive Toxicology, 80, 73-84

Jill Kohn. 2017. Iron. Academy of Nutrition and Dietetics. https://www.eatright.org/food/vitamins-and-supplements/types-of-vitamins-and-nutrients/iron. Accessed 10/6/2018

Kabir, Y., Shahjalal, H. M., Saleh, F., and Obaid, W. 2010. Dietary pattern, nutritional status, anaemia and anaemia- related knowledge in urban adolescent college girls of Bangladesh. J Pak Med Assoc. 2010;60(8):633– 8.

Kayani, Z., Bordbar, A-K., and Firuzi, O. 2018. Novel folic acid-conjugated doxorubicin loaded β-lactoglobulin nanoparticles induce apoptosis in breast cancer cells. Biomedicine and Pharmacotherapy, 107: 945 – 956

Kellee, A., Bartley, B. A., Richard, J., and Deckelbaum. 2005. A life cycle of micronutrientperspective for women's health. The American Journal of Clinical Nutrition, Volume 81, Issue 5, 1 May 2005, Pages 1188S–1193S, https://doi.org/10.1093/ajcn/81.5.1188

Keshavarzi, F., Ting, C. M., Yi, W. M., and Yi]usoff, N. H. 2016. Periconceptional Folic Acid Usage Pattern in Malaysian Women. *International Journal of Pharmaceutical and Clinical Research* 8(8): 1199-1204

Kohen, G. N., Derbent, A. U., Erof, O., Saygirr, N., Ayik, H., and Karaca, M. 2013. Awareness and use of folic acid among reproductive age and pregnant women.*J Turkish-German GynecolAssoc*14: 87-91

Leedy, P. D., and Ormrod, J. E. 2004. Practical Research, (8th Ed.). Upper Saddle River, N.J: Prentice Hall.

Levi, M., Rosselli, M., Simonetti, M., Brignoli, O., Cancian, M., Masotti, A., Pegoraro, V., Cataldo, N., Heiman, F., Chelo, M., Cricelli, I., Cricelli, C., and Lapi F. 2016. Epidemiology of iron deficiency anaemia in four European countries: a population-based study in primary care. Eur J Haematol, 97(6):583-593.

Lomborg, B. 2004. Global Crises, Global Solutions. Cambridge: Cambridge University Press.

Lumley, J., Watson, L., Watson, M., and Bower, C. 2001 Periconceptional supplementation with foliate and/or multivitamins for preventing neural tube defects. Cochrane Database Syst Rev:CD001056

Lwanga, S., and Lemeshow, S. 1991. Sample size determination in health studies: A practical manual. WHO Library. ISBN 92-4 1544068. *World Health Organisation*. Pp 1-3.

McLean, E., Benoist, B., and Allen, L. H. 2008. "Review of the Magnitude of Folate and Vitamin B12 Deficiencies Worldwide." Food and Nutrition Bulletin 29 (2 Suppl): S38–51

Menendez , C., Fleming, A. F., and Alonso, P. L. 2000. Malaria-related anaemia. Parasitology Today, 2000, 16:469–476.

Meyer, R. E., Hayes, A. G., Morgan, A. J., Devine, J. E., and Powers, K. E. 2001. Knowledge and Use of Folic Acid among North Carolina Women. *North Carolina Public Health.*126, 1-9

Moradi, F., Mohammadi, S., Kadivar, A. A., and Masoumi, S. J. 2007. Knowledge and practice of pregnant women in fars province about intake of iron supplements. ActaMedicaIranica 45(4): 301-304.

National Census Population. 2006. National Census Population, National Bureau of statistics, 2017. Demographic statics bulletin

National Institutes of Health. 2015. Vitamins and minerals. Accessed from https://nccih.nih.gov/health/vitamin in February, 2016

National Institutes of Health. 2018. Dietary Supplement Label Database.http://www.dsld.nlm.nih.gov/dsld/

National Population Commission. Population and Housing Census of Nigeria. Nigeria demographic and health survey, 2013

Nivedita, K., and Fatima, S. N. 2016. Knowledge, attitude and practices of pregnant womenregarding anemia, iron rich diet and iron supplementsand its impact on their hemoglobin levels.*International Journal of Reproduction, Contraception, Obstetrics and Gynecology.*5(2), 425-431

Nguyen, P. H., Nguyen, K. C., Le Mai, B., Nguyen, T.V., Ha, K. H., Bern, C., and Martorell, R. 2006. Risk factors for anaemia in Vietnam. Southeast Asain. Journal of Tropical Medicine and Public Health, 37,1213-1223

Okafor, I. M., Enosakhare, A., Antai, A. B., and Usanga, E. 2013. Prevalence of Iron Deficiency Anaemia among Pregnant Women in Calabar, Cross River State Nigeria.IOSR Journal of pharmacy and Biological Science. 7. 2319-7676.

Okafor, I.M., Okpokam, D.C., Antai, A.B., and Usanga, E. 2016. Iron Status of Pregnant Women in Rural and Urban Communities of Cross River State, South-South Nigeria.Niger. J. Physiol. Sci. 31:121-125

Padmadas, S.S., Dias, J. G., and Willekens, F. J 2016. Disentangling women's responses on complex dietary intake patterns from an Indian cross-sectional survey: a latent class analysis. Public Health Nutr. 2006;9:204–1

Peake, J. N., Copp, A. J., and Shawe, J. 2013. Knowledge and Periconceptional Use of Folic Acid for the Prevention of Neural Tube Defects in Ethnic Communities in the United Kingdom: Systematic Review and Meta-analysis. Birth Defects Research 97:444–451

Rajwinder, H., Mieke, F., Folake, S., Judith, K., and Afework, M. 2017. Micronutrient Status and Dietary Intake of Iron, Vitamin A, Iodine, Folate and Zinc in Women of Reproductive Age and Pregnant Women in Ethiopia, Kenya, Nigeria and South Africa: A Systematic Review of Data from 2005 to 2015. Nutrients 2017, 9, 1096; doi:10.3390/nu9101096 www.mdpi.com/journal/nutrients

Ramakrishnan, U. 2002. Prevalence of Micronutrient Malnutrition Worldwide. International Life Science Institute (II) S46 – S52

Rivera-Segarra, S., Ramos-Tollinchi, L., Cardenas-Suartez, N., and Romaguera, J. 2016. Knowledge and Use of Folic Acid among Women Attending the high-Risk Prenatal Clinics at the Adults University Hospital in Puerto Rico. *Int J Womens Health Wellness.*2(4): . doi:10.23937/2474-1353/1510043

Robson, C. 2011. Real World Research: A Resource for Users of Social Research Methods in Applied Settings, (2nd Ed.). Sussex, A. John Wiley and Sons Ltd.

Roswall, N., Olsen, A., Christensen, J., Dragsted, L. O., Overvad, K., and Tionneland, A. 2010. Micronutrient intake and risk of colon and rectal cancer in a Danish cohort.Cancer Epidemiol. 2010;34(1):40-6. https://www.ncbi.nlm.nih.gov/pubmed/20060798

Scholl, T. O., and Johnson, W. G. 2000. Folic acid: influence on the outcome of pregnancy. Am J Clin Nut, 71:1295S-303S

Scorsatto, M., Uehara, S. K., Luiz, R. R., Oliveira, G., and Rosa, G. 2011. Fortification of flours with folic acid reduces homocysteine levels in Brazilian women. Nutrition Research, Volume 31, Issue 12, Pages 889-895

Soetan, K. O., Olaiya, C. O., and Oyewole, O. E. 2010. The importance of mineral elements for humans, domestic animals and plants: A review. African journal of food science. Vol.4(5) pp200-222, May 2010

Sonkar, V. K., Khan, N. M., Domple, V. K., and Inamdar, I. F. 2017. Knowledge and practices of pregnant women regarding the iron supplementation during pregnancy.International Journal of Community Medicine and Public Health. 4(8), 2891-2894

Stolzfus, R. J. 2003. Iron deficiency: global prevalence and consequences. Food Nutr Bull, 24(4):S99-103

Taye, B., Abeje, G., and Mekonen, A. 2015. Factors associated with compliance of prenatal iron foliate supplementation amongwomen in Mecha district, Western Amhara: a cross-sectional study. *Pan African Medical Journal.* 20(43) 20:43 doi:10.11604/pamj.2015.20.43.4894

Tetaley, C.R., Dibley, M.J., Roberts, C.L., Hall, B. J., and Agho, A. 2009. Iron and folic acid supplements and reduced early neonatal deaths in Indonesia.Bulletin of the World Health Organization. DOI: 10.2471/BLT.09.065813.

Theng, C. E., Zakaria, N. S., and Yusof, H. M. 2017. Knowledge and attitude on consumption of iron Supplement among pregnant women in Kuala Terengganu, Terengganu. Malays. Appl. Biol. 46(3): 105–112

Thompson, B. and Amoroso, L. 2011. Combating Micronutrient Deficiencies: Food-based Approaches, Food and Agriculture Organization of the United Nations and CAB International, Rome, Italy,2011

Tiwari, A.K.M, Mahdi, A. A., and Mishra, S. 2018. Assessment of liver function in pregnant anemic women upon oral iron and folic acid supplementation. Journal of Gynecology Obstetrics and Human Reproduction

United States Food and Drug Administration. 2011. Background information on Dietary supplements. Retrieved in June 2015 from http://ods.od.nih.gov/factsheets/DietarySupplements-

vanEjisden, M., van der Wal, M. F., and Bonsel, G. L. 2006. Folic acid knowledge and use in a multi-ethnic pregnancy cohort: the role of language proficiency. *BJOG,* 113, 1446-1451

Wilson, R.D. 2015. Pre-conception Folic Acid and Multivitamin Supplementation for the Primary and Secondary Prevention of Neural Tube Defects and Other Folic Acid-Sensitive Congenital Anomalies. Journal of Obstetrics and Gynaecology Canada, 37 (6) 534 - 549 https://www.sciencedirect.com/science/article/pii/S1701216315302309

World Health Organization. 2001. Iron deficiency anaemia: assessment, prevention, and control. A guide for programme managers. Geneva(WHO/NHD/01.3).

World Health Organization. 2005. Assessing the iron status of populations: report of a Joint World Health Organization/ Centers for Disease Control and Prevention Technical Consultation on the Assessment of Iron Status at the Population Level, Geneva, Switzerland, 6–8 April 2004. Geneva.

World Health Organisation. 2006. Guidelines on food fortification with micronutrients. Edited by Lindsay Allen, Bruno de Benoist, Omar Dary and Richard Hurrell

World Health Organization. 2008. Worldwide Prevalence of Anaemia 1993–2005: WHO Global Database on Anaemia.

Wyatt, C. M., and Spence, J. D. 2016. Folic acid supplementation and chronic kidney disease progression. Kidney International. 90 (6) 1144 – 1145

Yeung, L. F., Cogswell, M. E., Carriquiry, A. L., Bailey, L. B., Pfeiffer, C. M., and Berry, R. J. 2011. Contributions of enriched cereal-grain products, ready-to-eat cereals, and supplements to folic acid and vitamin B-12 usual intake and folate and vitamin B-12 status in US children: National Health and Nutrition Examination Survey (NHANES), 2003-2006. Am J ClinNutr, 93(1):172-85.

Zhou, C., Zhu, L., Wu, J., and Fang, S. 2013. Is folic acid supplementation definitely beneficial to stroke prevention?: Comment on: Efficacy of folic acid supplementation in cardiovascular disease prevention: An updated meta-analysis of randomized controlled trials. European Journal of Internal Medicine, 24 (4):e55

APPENDICES

APPENDIX 1

QUESTIONNAIRE

KNOWLEDGE, PERCEPTION AND INTAKE OF MICRONUTRIENTS (IRON AND FOLIC ACID) AMONG FEMALE CIVIL SERVANTS OF REPRODUCTIVE AGE AT THE STATE SECRETARIAT, IBADAN

INFORMED CONSENT FORM

Dear Respondent,

My name is Olaniyi, Oluwadamilola Aanu a postgraduate student of the Department of Health Promotion and Education, Faculty of Public Health, College of Medicine, University of Ibadan. The purpose of this study is to investigate the **knowledge, perception and intake of micronutrients (Iron and Folic acid) among Women of Reproductive Age**. Iron and folic acid are micronutrients needed in the body in small quantities for optimal body performance. The result of this study will provide information about the knowledge and perception of micronutrient among women of reproductive age, determine the dietary and supplement intake of iron and folic acid among women of reproductive age and identify their source(s) of information about intake of micronutrients. There are no rights or wrong answers to the questions asked or the statements made, what is desired of you is honest responses to ensure the success of the research. This is a voluntary participation and you have the right to withdraw at anytime. Be assured that there are no risks associated with your participation in this study. All information provided will be treated with utmost confidentiality and will be solely used for research purpose. Kindly indicate your willingness to participate by inputting your initials below.

CONSENT: Now that I understand the content of the process of this study, I am willing to take part in this study survey.

Initials:……. Date:…….

Serial No:……..

SECTION A: SOCIO-DEMOGRAPHIC INFORMATION

1. Age (in years): …… 2. Ministry: ……..…

3. Designation: ……

4. Marital Status: 1. Never Married ( ) 2. Married ( ) 3. Divorced ( ) 4. Widowed ( )
5. Separated ( )

5. Ethnic Group: 1.Yoruba ( ) 2.Hausa ( ) 3.Igbo ( ) 4. Others (Specify)……..

6. Type of family: 1. Monogamous ( ) 2. Polygamous ( )

7. Family Size: 1. 2 ( ) 2. 3 ( ) 3.4 ( ) 5. 6 ( ) 6. 7 and above ( )

8. Educational Level: 1.Primary ( ) 2. Secondary ( ) 3.Tertiary ( )
4. Others (Specify)……

9. How many years have you spent on this job? 1. 0-2years ( ) 2. 3-5years ( ) 3. 6-10years ( )
4. more than 10years ( )

10. Have you ever been diagnosed with Anaemia in the last one year ? 1. Yes ( ) 2. No ( )

11. Do you have any health problem? 1. Yes ( ) 2. No ( )

(if No, kindly proceed to the next section)

12. If yes, what is the health problem? ….……

SECTION B: KNOWLEDGE OF MICRONUTRIENTS (IRON AND FOLIC ACID)

In this section you will be asked certain questions, please answer to the best of your ability. Any information shared will be greatly appreciated. Kindly leave the score column vacant, it is for the researchers' use.

S/N	QUESTION	ANSWER/RESPONSE	SCORE
13	What is dietary iron		
14	List 3 functions of dietary iron in the body	i ii ii	
15	Mention 3 important sources of dietary iron	i ii iii	
16	Mention 2 category of people that requires adequate intake of dietary iron	i ii	
17	Mention 2 health conditions that can occur due to inadequate intake	i	

	of dietary iron	ii	
18	What is referred to as iron supplement		
19	State a reason that necessitate dietary iron supplement		
20	What is folic acid		
21	Mention 3 sources of folic acid	i ii iii	
22	List 3 functions of folic acid in the body	I ii iii	
23	Mention 2 category of people that requires adequate intake of folic acid	I ii	
24	Mention 2 health implications of inadequate intake of folic acid	I ii	
25	What is referred to as folic acid supplement		
26	Mention 1 importance of folic acid supplement		
27	Total score obtained		
28	Code		

SECTION C: PERCEPTION OF MICRONUTRIENT (IRON AND FOLIC ACID)

Instruction: please tick (√) the option that appropriately reflects your response

S/N	STATEMENT	AGREE	DISAGREE
29	There is no adverse effect associated with inadequate intake of dietary iron in the body		
30	Non communicable diseases such as anaemia can be prevented with adequate intake of dietary iron		
31	My intake of dietary iron is insignificant to my health status		
32	Constant experience of fatigue may be due to insufficient intake of dietary iron		
33	Sufficient intake of dietary iron constitute to speedy recovery from illness		
34	Adequate intake of dietary Iron is important only during pregnancy		

35	Only old people need adequate intake of iron		
36	Taking iron supplement is only needed when recommended daily intake of iron is not met through dietary intake		
37	The level of education of an individual may determine his or her dietary iron intake		
38	Inadequate intake of folic acid can enhance potential risk of anemia		
39	My intake of folic acid is insignificant to my health		
40	Only pregnant women are affected with diseases associated with insufficient intake of folic acid		
41	Regular consumption of folic acid might enhances the capacity of the immune system to fight diseases		
42	There are no adverse effects associated with insufficient folic acid in the body		
43	Sufficient intake of folic acid enhances speedy recovery from illness		
44	Only old people needs adequate intake of folic acid		
45	Taking folic acid supplement is needed even when recommended daily intake of folic acid is met through our food intake		
46	The level of education of an individual may determine his or her folic acid intake		
47	**TOTAL SCORE OBTAINED**		
48	**CODE**		

SECTION E: Dietary History

Instruction: Kindly tick (√) as appropriate to indicate how often you include the following food items in your meal

S/N	**FOOD ITEM**	**How often do you consume these items?**			
		Regularly(more than 4 times a week)	**Occasionally(1-3 times in a week)**	**Rarely(once or less)**	**Never**
	Haem-Iron				
49	Liver				
50	Sardine fish				
51	Meat				
52	Poultry(chicken, turkey)				
53	Pork				
	Non-haem Iron				
54	Bitter leaf (efo ewuro)				
55	Kidney bean				
56	African Spinach (efo tete, shoko)				
57	Soy-beans				
58	Waterleaf (gbure)				
59	Lentils				
	Folic acid				

60	Rice				
61	Avocado				
62	Noodles				
63	Citric fruits(Oranges, lime)				
64	Okro				
65	Corn flakes				

SECTION F: INTAKE OF MICRONUTRIENT SUPPLEMENT

Instruction: Kindly tick [√] as appropriate to indicate your micronutrient supplement intake

66. How do you ensure that your micronutrient intake is adequate?

…….

S/N	SUPPLEMENT TYPE	Regularly	Rarely	Never
67	Iron supplement			
68	Folic acid supplement			
69	Multivitamin			

70. Why do you use any of these supplements?

A. Because of pregnancy ( ) B. To ensure adequate micronutrient intake ( )

C. Peer pressure ( )

SECTION G: SOURCES OF INFORMATION ON MICRONUTRIENTS

S/N	STATEMENT	Always	Often	Rarely	Never
71	How often do you acquire information about dietary iron?				
72	My friends provide me with information on dietary iron				
73	I gather information about adequate dietary iron intake from trainings, workshop, seminars, etc				
74	I acquire knowledge about dietary iron from health organizations				
75	I obtain information on dietary iron from my family members				
76	I encounter information on recommended dietary iron intake from social clubs				
77	How often do you acquire information about folic acid ?				
78	My friends provide me with information about folic acid				
79	I gather information about recommended folic acid intake from trainings, workshop, seminars, etc				
80	I acquire information about folic acid from health organizations				
81	I obtain information on folic acid from my family members				
82	I encounter information on adequate folic acid intake from social clubs				

Thank you for your time.

APPENDIX II

ETHICAL APPROVAL LETTER

TELEGRAMS…….. TELEPHONE……..

OYO STATE: THE PACESETTER

MINISTRY OF HEALTH

DEPARTMENT OF PLANNING, RESEARCH & STATISTICS DIVISION

PRIVATE MAIL BAG NO. 5027, OYO STATE OF NIGERIA

Your Ref. No. ……..

All communications should be addressed to the Honorable Commissioner quoting

Our Ref. No. AD 13/479/1048

13th December, 2018

The Principal Investigator,
Health Promotion and Education,
Faculty of Public Health,
College of Medicine,
University of Ibadan,
Ibadan.

Attention: Olaniyi Oluwadamilola

ETHICS APPROVAL FOR THE IMPLEMENTATION
OF YOUR RESEARCH PROPOSAL IN OYO STATE

This is to acknowledge that your Research Proposal titled: "Knowledge, Perception and Intake of Micronutrients (Iron and Folic acid) among Female Civil Servants of Reproductive age at the Oyo State Secretariat, Ibadan" has been reviewed by the Oyo State Ethics Review Committee.

2. The committee has noted your compliance. In the light of this, I am pleased to convey to you the full approval by the committee for the implementation of the Research Proposal in Oyo State, Nigeria.

3. Please note that the National Code for Health Research Ethics requires you to comply with all institutional guidelines, rules and regulations, in line with this, the Committee will monitor closely and follow up the implementation of the research study. However, the Ministry of Health would like to have a copy of the results and conclusions of findings as this will help in policy making in the health sector.

4. Wishing you all the best.

RESEARCH ETHICAL REVIEW … OYO STATE … MINISTRY OF HEALTH

Dr. Abbas Gbolahan
Director, Planning, Research & Statistics
Secretary, Oyo State, Research Ethics Review Committee